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VOLUME 18

EDITED BY

J. R. AKEROYD, J. R. EDMONDSON, R. J. GORNALL

C. D. PRESTON AND B. S. RUSHTON

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Errata

p. 23, line 19 up.	For: *ALBONIS*	read: *ALBIONIS*
p. 71, line 26.	*For: bella-donna*	*read: belladonna*
p. 71, line 15 up.	For: *viridus*	read: *viridis*
p. 75, line 14 up.	For: *viridus*	read: *viridis*
p. 76, line 23 up.	For: *viridus*	read: *viridis*
p. 79, line 6.	For: *Hippurus*	read: *Hippuris*
p. 79, line 3 up.	For: *officinalis*	read: *sagittifolia*
p. 97, line 20.	For: *americanum*	read: *americanus*
p. 181, line 12.	For: *Sinapsis*	read: *Sinapis*
p. 271, line 3.	For: *greyii*	read: *grayi*

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The B.S.B.I. Black Poplar survey, 1973–88

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ABSTRACT

The B.S.B.I. Black Poplar survey is described and the chief results reported. The distribution of the Black Poplar, *Populus nigra* L., in Britain is shown to be concentrated chiefly in the flood plains of lowland rivers in England and Wales, where it is probably native, but where it has also been widely planted in the past. The probable reasons for its failure to reproduce naturally by seed in the British countryside today are explained.

THE SURVEY AND ITS RESULTS

I have been interested in *Populus nigra* L. (Fig.1) since my student days at Cambridge, where I was infected by the enthusiasm for this tree of Humphrey Gilbert Carter, Director of the University Botanic Garden. He showed botany students three standard Black Poplars at Madingley (now no more, the last having been cut down in 1984) and demonstrated the characters separating them from the commonly grown hybrid *P.* × *canadensis* Moench var. *serotina* (Hartig) Rehder.

During the next 45 years I made mental notes of Black Poplars whenever I came across them in England and Wales, and began to realize what an uncommon tree it was. I helped my father prepare the account of *P. nigra* in Gloucestershire (Riddelsdell, Hedley & Price 1948). I submitted a number of records of the species to the B.S.B.I. Mapping Scheme, and was disappointed when the *Atlas* (Perring & Walters 1962) appeared and the map showed a hotchpotch of species and hybrids, with no recognizable distribution, as many of the contributors could not separate the species from the hybrids!

So, when I retired in 1971 and came to live in Suffolk, I discussed the problem of mapping its distribution with Franklyn Perring (then at the Biological Records Centre, Monks Wood), and offered to undertake a survey of the occurrence of the species in Britain for the B.S.B.I. This started in earnest in 1973: recording-cards were prepared by the Society and sent to its members, and records started to come in. Many I knew to be correct, but others were doubtful, and I soon realized that a lot of checking was going to be necessary in order to eliminate hybrids from the survey. Before long I had compiled a short list of members who knew the native tree and whose records could be trusted, and a longer list of doubtful trees which needed checking before being accepted. All firm records were entered on record cards left over from the mapping scheme and were periodically sent to Monks Wood. The cards recorded the vice-county, the six-figure map reference, the parish, site and altitude, the habitat, the sex (if known), whether standard or pollard, and the recorder's name.

In 1976 I obtained a small grant from the World Wildlife Fund (as it then was) which enabled me to make a fortnight's tour round some of the Black Poplar sites in England and Wales, visiting Hampshire, Dorset and Devon, then north through Somerset, Gwent and Powys to Shropshire and Clwyd, east through Cheshire, Staffordshire and Derbyshire to Lincolnshire and back to Suffolk by Huntingdon and Cambridge. Many doubtful records were confirmed or rejected, and I was able to meet several of my valuable helpers who showed me some of their more outstanding finds, including the first coppiced Black Poplar I had ever seen! This was a most useful trip as, seeing the tree in many different habitats, I got a better idea of the degree of variation within the species. I also began to realize that Black Poplars were largely planted by man, who grew the saplings from cuttings, which usually resulted in local clones of one sex developing.

At this time I knew of only one site in Britain where trees of both sexes grew close enough together to produce abundant fertile seed and, as no male hybrid was to be seen around when I visited this Cheshire site, the seed produced would almost certainly be pure *P. nigra*. I now know of

FIGURE 1. Specimen of *Populus nigra*, near Butley Church, E. Suffolk, v.c. 25; photographed by P. Webb, March 1975.

about half a dozen sites where male and female trees grow close enough together to produce some fertile seed, but I have not checked all of them for the absence of nearby male hybrids. I searched in vain for seedlings or saplings around the Cheshire trees, in spite of the fact that probably one million fertile seeds are produced there every year!

The seeds of *P. nigra* need to fall on bare wet mud, soil or silt at the end of June, and the site has to remain bare and wet till leaf-fall in October. The seedling will perish during these first few critical months if there is a drought or if the site gets flooded. By October it will be 10–15 cm high and its roots will have got down about 30 cm. It can then tolerate adverse conditions the following summer. But where do you find bare wet surface conditions in the summer countryside today?

In early days, before the lowland rivers were tamed by man, they used to erode their banks during

winter floods and deposit quantities of silt, making suitable habitats for Black Poplar seed to germinate. Every now and then one or two out of the million or so produced by one tree would be successful, and the species would regenerate naturally.

On my trip I saw few young Black Poplars and none that could have grown from seed, and now, after 15 years studying this tree, I know of only one probable natural seedling in the whole of England and Wales – in E. Suffolk, v.c. 25. The only other recorded seedling, of which I have read, is mentioned in Druce (1927) near Osney, Oxon, v.c. 23, "on mud dredged from the river [Thames]". To understand the status of *P. nigra* in Britain today, one has to realize that its very existence in our countryside is due to man. Many Floras dismiss it as an alien because it always seems to have been planted. Had it not been planted it would have become extinct long ago!

One reason for the scarcity of the Black Poplar in Britain today is the advent of the man-made hybrid poplars, which became popular early last century and which were widely planted by landowners in place of the native species. Tree-nurseries built up stocks of them and *P. nigra* soon became a forgotten tree. Few if any were planted after the middle of the nineteenth century, so that most of the standard trees here recorded are getting past maturity and starting to die back.

In the early days (1000 years ago or more) *P. nigra* was, in my opinion, a native British tree in the flood plains mainly of lowland rivers in England and Wales, and most occurred south of a line from the Humber to the Mersey. However, on the eastern side it occurred here and there through Yorkshire reaching as far north as the Tees in Co. Durham, v.c. 66. It is not native in Scotland. The high ground in central Wales and in Devon seems to have formed a barrier, and I have only two records for the western coastal areas: a tree (old in 1919) on the lawn of Weare Gifford Hall, N. Devon, v.c. 4, and a stunted tree by the now derelict farm buildings on Skomer Island, Pembs., v.c. 45, both almost certainly introduced. The trees recorded on the River Lune in W. Lancs., v.c. 60, are also introduced, but that is another story!

The distribution today shows *P. nigra* as a lowland tree, being absent from the North and South Downs, the Chilterns, the Cotswolds and the Mendips. It occurs near the sea in N. Somerset, v.c. 6; Dorset, v.c. 9; Wight, v.c. 10; S. Hants., v.c. 11; W. Sussex, v.c. 13; N. Essex, v.c. 19; E. Suffolk, v.c. 25; Flints., v.c. 51; N. Lincs., v.c. 54; and N. E. Yorks., v.c. 62. It is surprisingly scarce in the three southern counties of Hampshire, Sussex and Kent; it appears to have gone from several sites in N. Somerset; and there are very few records from Leicestershire and Nottinghamshire.

There are certain areas where it has been grown extensively as pollards, the most outstanding being the Vale of Aylesbury, where it is by far the most common tree. Pollards also dominate the area of smallholdings known as Castlemorton Common in Worcestershire, the Thames valley west of Wallingford, Berks., v.c. 22, and an area between Taunton and Minehead in S. Somerset, v.c. 5.

In most of its localities it grows at altitudes of well under 100 m, but in Berks., v.c. 22, Bucks., v.c. 24, and Worcs., v.c. 37, it reaches 130 m; in Herefs., v.c. 36, it is found at 200 m; and in Salop, v.c. 40, at 270 m; but the altitude record at present is held by a tree of considerable age flourishing at 300 m in the parish of Penstrowed in Monts., v.c. 47.

Countrymen and farmers over the centuries have found the timber of the native Black Poplar and the poles from pollards useful and it has been extensively propagated. Cook (1676) tells his readers "You that have wet grounds get [some truncheons of Water Poplar] to set by your ditches. . . . , for if you set one worth a half penny, if they grow they will bring you that yearly for twenty years or more". Evelyn (1664) describes how to propagate the tree by truncheons, seven to eight feet long, but Hunter (1776) prefers cuttings planted out in nurseries, and mentions sides of rivulets, bogs, pasture-grounds and fields as suitable sites for planting out. None of these authors mentions growing the tree from seed.

Not understanding the biology of *P. nigra* and its inability to propagate itself by seed, and noticing that most trees occurred in sites where they had obviously been planted, many authors of county and local Floras dismissed the species as not being native. For instance, Murray (1896) excludes it from being a native Somerset tree with the comment "often planted", whilst Druce (1927) considered it an alien in Oxfordshire. Hyde (1931) states "rare in Wales, even as a planted tree", but Wade does not mention it as a native flowering plant of Wales (Hyde & Wade 1957). However, it seemed to Elwes & Henry (1913) to be a native of the counties of the Welsh border, where it was fairly common, and they also considered it was probably indigenous in East Anglia. Other authors failed to distinguish *P. nigra* from the commonly planted variants of *P.* × *canadensis*, and one, whose Flora was in manuscript when I offered to check his account of *P. nigra*, refused my offer, saying it

was not possible to distinguish it from the hybrids, resulting, in due course, in a useless account of its occurrence and distribution in his county!

During the past 15 years I have accumulated a wealth of information about this magnificent tree, and I hope to write a further paper covering its nomenclature, genetical variation, ability to regenerate vegetatively and its uses, as well as some remarks on the fauna associated with it or which makes use of it. I hope also to deal with its status in Ireland and continental Europe.

The accompanying distribution map (Fig. 2) was up-to-date when submitted for publication, and I

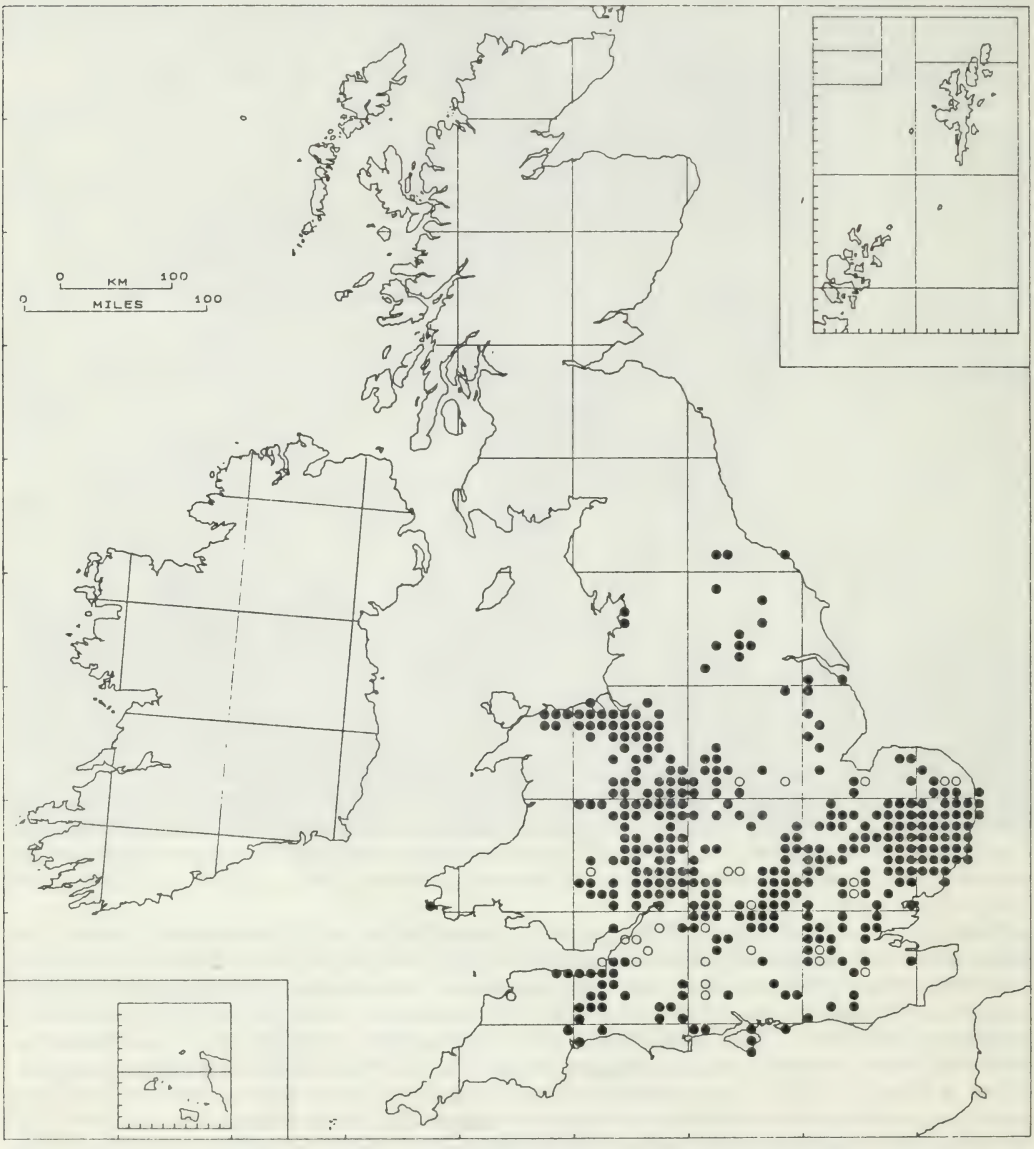

FIGURE 2. The distribution of *Populus nigra* in Britain. ● 1960 onwards, ○ pre-1960 or extinct.

am still prepared to receive records. The map may give the impression that the Black Poplar is a common tree, for instance in East Anglia, but a dot very often represents the presence of only one tree in an area of 100 square kilometres!

I have omitted from the map records of the Manchester Poplar, which is a male clone of *P. nigra* of unknown origin. Over 100 years ago it was extensively planted from nursery stock in the older suburbs of Manchester, as it was found to thrive in the heavily polluted atmosphere at that time. For more information about the Manchester Poplar see Stace (1971).

Readers may care to compare this map with that published in Perring & Walters (1962), and they will then see why I was anxious to discover the true distribution in Britain of our rarest and most splendid native timber tree.

ACKNOWLEDGMENT

I am most grateful to Mrs J. M. Croft and C. D. Preston for helping to produce the distribution map.

REFERENCES

Cook, M. (1676). *Manner of raising, ordering and improving forest trees*, p. 81. London.
Druce, G. C. (1927). *The flora of Oxfordshire*, 2nd ed., p. 394. Oxford.
Evelyn, J. (1664). *Sylva*, p. 36. London.
Hunter, A. in Evelyn, J. (1776). *A discourse on forest trees: notes*, p. 209. York.
Hyde, H. A. (1931). *Welsh timber trees, native and introduced*, pp. 42–43. Cardiff.
Hyde, H. A. & Wade, A. E., (1957). *Welsh flowering plants*, 2nd ed., p. 153. Cardiff.
Murray, R. P. (1896). *The flora of Somerset*, p. 308. Taunton.
Perring, F. H. & Walters, S. M., eds (1962). *Atlas of the British flora*, p. 187. London.
Riddelsdell, H. J., Hedley, G. W. & Price, W. R. (1948). *Flora of Gloucestershire*, p. 441. Cheltenham.
Stace, C. A. (1971). The Manchester Poplar. *Watsonia* **8**: 391–393.

(*Accepted February 1989*)

Hedera helix L. and *H. hibernica* (Kirchner) Bean (Araliaceae) in the British Isles

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ABSTRACT

Hedera helix L. sensu lato consists of diploids, *H. helix* L. sensu stricto, and tetraploids, *H. hibernica* (Kirchner) Bean, which have distinct geographical distributions and can be differentiated morphologically especially by their trichomes.

INTRODUCTION

The plant known as Irish Ivy, *Hedera hibernica* hort. or *H. helix* subsp. *hibernica* (Kirchner) McClintock, is widely used as a ground cover plant which frequently escapes from cultivation and may be found far from habitation. Its rapid growth, large and uniform leaves, hardiness, shade tolerance and lack of inclination to climb make it a landscape architect's ideal subject for planting beneath trees and shrubs and for stabilising steep slopes.

The origin of the material in cultivation has long been a matter for dispute (Lawrence & Schulze 1942) though many writers have stated that it is native in Ireland, and Mackay (1836) mentions receiving specimens from Ballybunion in Kerry. However, this ivy is rare in cultivation in Ireland and Andrews, who was the originator of the myth of 'Irish' ivy in Ireland (Mackay 1836), is known to have been unreliable over the labelling of his plants (M. J. P. Scannell, pers. comm.). By the second half of the last century, it was not regarded as native there (Hooker 1870; Colgan & Scully 1898). Whatever its origin, it is now very common throughout Britain (Rutherford 1979), America (Lawrence & Schulze 1942) and probably many other countries.

In an attempt to discover more about the plant, A. R. originated the B.S.B.I. Network Research Project on Irish Ivy (1975–1979); see Rutherford (1979). Apart from the gross morphological characters of large, uniform, broadly lobed leaves, Irish Ivy can usually be distinguished from the common ivy by its smell. The odour of *H. helix* L. is very disagreeable to many people, but the scent of cut twigs or petioles of Irish Ivy is much more powerful, distinctly sweeter and more resinous. Only *H. colchica* K. Koch and *H. algeriensis* Hibb. are equally odoriferous. Jacobsen (1954) reported *H. hibernica* hort. to be tetraploid (2n=96) and *H. helix* to be diploid (2n=48). He used cultivated material of *H. hibernica* but believed it to represent a wild species.

CYTOLOGICAL METHODS

The method used was a modification of Dyer's lacto-propionic orcein technique (Dyer 1963) in which the root tips were squashed in the undiluted saturated solution of orcein in 1:1 lactic acid:propionic acid. Rapidly growing root tips were placed in vials of a saturated solution of α-monobromonaphthalene in tap water for about 4 h at room temperature. The root tips were then

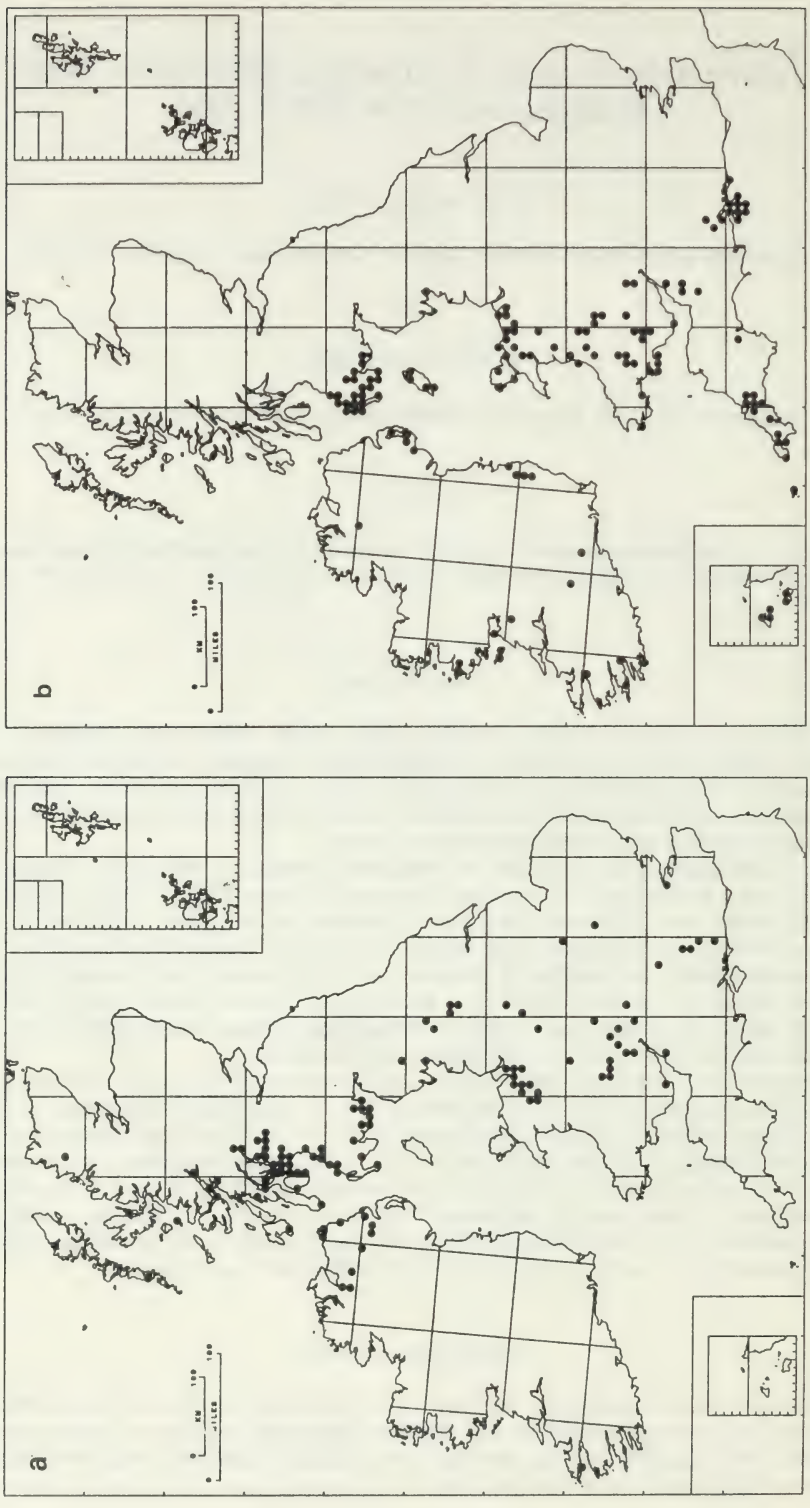

FIGURE 1. Distribution of counts of (a) diploid (2n=48) *Hedera helix* L. and (b) tetraploid (2n=96) *H. hibernica* (Kirchner) Bean in the British Isles.

fixed in 1:3 methanoic (acetic) acid:ethanol (98%) for at least 24 h, before being hydrolysed in 1M hydrochloric acid at 60°C for about 5 minutes in a water bath, and then transferred to 70% ethanol for storage. A root tip was then examined under a dissecting microscope, placed in a drop of stain, macerated with needles, tapped and squashed.

The squash preparations were examined for cells containing well separated chromosomes and, when such were found, the chromosomes were counted. With clear preparations, counts of precisely 2n=48 or 2n=96 were obtained, but on poorer preparations, where only approximate counts (45–48 or 90–96) could be made, the results were recorded as 2n=c.48 or 2n=c.96.

CYTOLOGICAL RESULTS

It was soon confirmed that the cultivated Irish Ivy, *H. hibernica* hort., and some other cultivars were tetraploid, as well as much of the wild material from all along the western seaboard of Britain and Ireland, western France and Spain. In the wild, tetraploids seem to occur to the exclusion of diploids in southern Ireland, the Isle of Man, western Wales, the West Country eastwards to the Isle of Wight and the New Forest, the Channel Isles, western France, northern Spain and probably most of that country except the Sierra Nevada region where diploids occur, and in the Algeciras–Gibraltar area and in Portugal, near Lisbon, where hexaploids (2n=144) have been found. Diploids and tetraploids were found together along the eastern boundary of the area of distribution of the tetraploids, but further east only diploids were found, apart from the occasional naturalised tetraploid *H. hibernica* hort. (Fig. 1).

The diploid thus appears to be the native ivy north and east of the tetraploid's area in Britain. Diploids have been counted from eastern France, Denmark, Switzerland, Italy, Yugoslavia, Turkey, the Crimea and the Caucasus. Thus the tetraploid seems to occur to the exclusion of the diploid on the Atlantic seaboard of Europe, from Gibraltar to southern Scotland, and the diploid to the exclusion of the tetraploid north and east of these areas, extending eastwards to the Crimea and the Caucasus. It would appear that the diploid only reaches the Atlantic in central and northern Scotland. The one notable exception to this is the isolated occurrence in Sicily of tetraploids which are morphologically like diploid *H. helix*.

As the diploids and tetraploids have distinct, barely overlapping, geographical distributions, it may be said that they are behaving as distinct 'biological' species, with different climatic preferences, so the two cytotypes are probably in competition with one another where they meet. No hybrids (triploids, 2n=72) have yet been found despite many cytological determinations on material from areas where the two species meet.

MORPHOLOGY

As both the wild diploids and tetraploids have clearly all been previously referred to *H. helix*, it was considered that any character which might distinguish the two cytotypes was likely to be fairly cryptic. *H. hibernica* hort. was thought to be perhaps an extreme variant of the tetraploid, so it was carefully compared with a typical diploid *H. helix*. As the trichomes on the young leaves give useful diagnostic characters for distinguishing other species of *Hedera*, those on *H. helix* and *H. hibernica* hort. were examined in detail. These trichomes always consist of a short stalk bearing a central boss from which radiate a variable number of unicellular rays. In the diploid some of the rays of most of the trichomes stand up at an angle to the leaf surface giving a bristling appearance (Fig. 2a). By contrast, in *H. hibernica* hort. these rays almost always lie flat along the surface of the leaf, all in one plane (Fig. 2b). It was soon evident that all the tetraploids, excepting those from Sicily, had trichomes of the *H. hibernica* hort. type, while all the diploids had trichomes of the type found in the typical diploid examined. It therefore seemed clear that *H. hibernica* hort. was a distinctive clone or variety of a widespread tetraploid taxon, most specimens of which would previously have been classified as *H. helix*.

Although very obvious in young leaves on rapidly growing shoots, the trichome character is by no

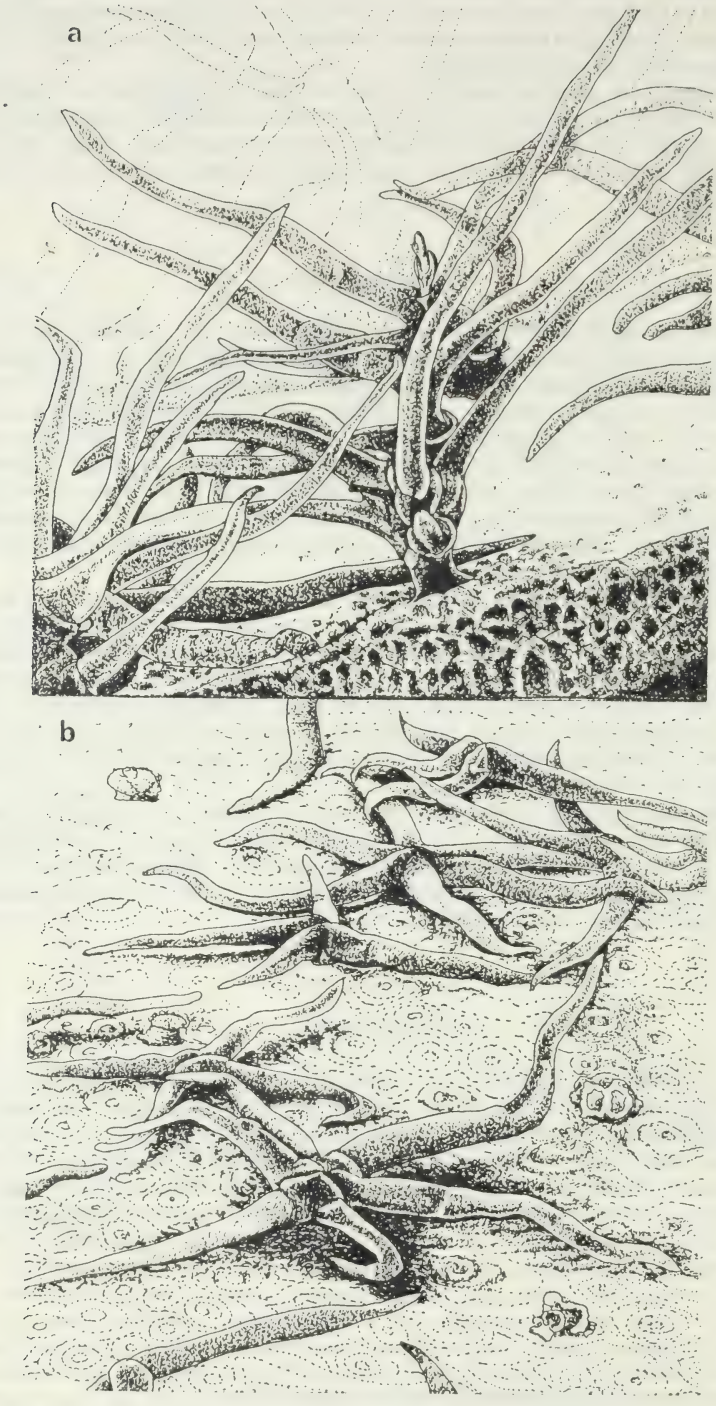

FIGURE 2. Drawings from stereoscan electron micrographs of the trichomes of (a) *Hedera helix* L., (b) *H. hibernica* (Kirchner) Bean.

means easy to use. Very young leaves of the diploid seem to be covered in fine grey-white velvet, the effect being created by the denseiy packed trichomes. On the tetraploid comparable young leaves seem much less hairy, since few of the trichomes stand out at an angle from the surface of the leaf. However, the best leaves to examine for determination of this character are slightly further back on the shoot, where the lamina expansion has separated the trichomes so that individual trichomes can be clearly distinguished. Observations in a good light with a ×20 hand lens are usually adequate, and with good, young, vigorous material held up to the light the cytotypes can often be distinguished with the naked eye – but such observations should always be checked with a lens. It is best to examine trichomes on the underside of the leaves, but those on the upper surface and on young leaves may also be examined. Trichomes on the upper surface and trichomes with rays standing out from the surface tend to be lost first as these are most likely to be abraded, so surfaces presenting few trichomes may give unreliable determinations. The last sites to lose their trichomes are the interveinal areas between the main veins, where they adjoin the petiole, on the underside of the leaf. Trichomes on slightly older stems of both cytotypes tend to have all their rays appressed to the stem, and some trichomes on the veins of the tetraploid have rays standing out from the leaf surface, so trichomes on stems and veins are best disregarded.

Furthermore, in winter, in exposed positions, on slow-growing or flowering shoots, the trichomes of the diploids with their projecting rays may become dislodged or be flattened on to the leaf surface, and such material may be unidentifiable unless taken into cultivation and fresh young leaves examined. It can be seen, therefore, that on the trichome character, the diploid is much more likely to be misidentified as the tetraploid than vice versa.

Used with care, examination of the trichomes is a reliable means of distinguishing between the Common (diploid) and the Atlantic (tetraploid) Ivies, but other characteristics are also more or less correlated with the chromosome number (Table 1). The leaf shape is very variable in both. Many 'races' of each pass through many changes between the creeping, sterile phase and the flowering, mature phase. Some tetraploids scarcely alter, having almost flowering-type foliage at all stages, and a variant of this has long been known from the Channel Isles (Druce 1912). Both cytotypes usually produce the familiar ivy-shaped leaves at an early stage in the plant's development. Later, before the mature phase is reached, both have, usually, a pedate-leaved phase in which the lobes are attenuate and the central much longer than the side lobes, and towards the flowering branches these lateral lobes diminish and entire leaves are produced.

ECOLOGY

In moist, sheltered sites the tetraploid is capable of dominating the woodland floor, roadside banks and cliffs in a manner of which the diploid seems incapable, even in the most favourable conditions. As early as 1872, Hibberd remarked on ivies with giant leaves in the Vale of Conwy and we have noted populations on Porkellis Moor, Cornwall, near Blackgang on the Isle of Wight, West Symonds Yat in Avon and even in woods by the mouth of the River Stinchar in Ayrshire, near the northern limit of the natural distribution of the tetraploid. The ability of the tetraploid to produce larger leaves on longer petioles, and to have longer internodes, apparently allows it to invade habitats unavailable to the other cytotype. Shingle banks just above high water level of spring tides are often colonised by the tetraploid, but the diploid has never been found in such habitats.

The vigour of the tetraploid is clearly seen among the sea-cliffs at Kennedy's Pass and at Pinbain Burn-foot, Ayrshire, where it is the dominant plant. Ivy grows to a considerable height up the cliffs, covers the seaside boulders and creeps through dry sunny roadside verges where it is not discouraged by being mown. Where not cut, this ivy competes successfully with *Pteridium aquilinum*, *Dryopteris filix-mas*, *Mercurialis perennis*, *Filipendula ulmaria*, *Poa pratensis*, *Rumex crispus* and *Rubus latifolius*, among other tall-growing species. It flourishes in two habitats at the former site which would probably have proved too extreme for the diploid, these being a dry, sunny exposure in very well-drained soil and a marshy ditch. In areas where both cytotypes occur, especially in Galloway in south-western Scotland (A. J. Silverside, pers. comm.), the tetraploid is mostly found in the milder, coastal regions while the diploid tends to be the ivy of the inland woods.

TABLE 1. A COMPARISON OF THE CHARACTERISTICS OF *HEDERA HIBERNICA* AND *H. HELIX*

Character	*H. hibernica* (Kirchner) Bean	*H. helix* L.
Growth	Fast and vigorous, often has long internodes, up to 18 cm or more. New shoots may be thick and succulent.	Markedly less vigorous and usually slower; internodes often quite short. New growth often wiry.
Leaf size	Leaves variable both at different phases and among different plants but overall considerably larger, up to 10 cm wide by 10 cm long in moist sheltered localities.	Leaves variable at different phases and among different plants, but generally markedly smaller at all phases.
Pedate leaves	The leaves at the pedate phase frequently the largest and almost equal in surface area to those at sub-fertile and fertile phases. The tip of the longer central lobe usually rounded.	The leaves at the pedate phase mostly produced near the ground and on the whole plant almost always the smallest; the tips of the longest lobes acute.
Leaf texture	Leaves usually coriaceous, frequently fleshy-waxy.	Leaves leathery, often of papery texture, but thin in coastal areas.
Leaf colour	In cold the interveinal areas of leaves may turn pinkish or light bronze. The veins develop apple-green borders. Some forms with low anthocyanin content only have red margins or do not darken at all, rarely the leaf becomes red-maroon.	In cold, particularly in frosty places, the leaves may turn purple-black all over; the ground colour darkens considerably.
Hyaline layer	The hyaline layer is more readily apparent and may appear thicker due to the upturned margins.	The hyaline layer is not readily visible, due to the down-turned margins.
Leaf sinuses	The sinuses are mostly deep and often strongly arched; leaves may be funnel-shaped.	The sinuses may be deep but the blade is usually flat, apart from the margins.
Leaf veins	The veins at the sterile phases rarely raised on the leaf surface and seldom differ in colour from the ground, usually bordered in a paler shade or yellow-green.	The veins at the sterile phases almost always raised on the leaf surface like fine wires, often silver-white, rarely edged with paler colour.
Trichomes	Trichomes appear sparse due to the rays lying parallel to the leaf surface; they are often tinted fawn or more rarely orange-brown.	Trichomes appear as grey-white pubescence on new tips, due to the rays projecting at various angles and becoming enmeshed.
Sap	Sap odour strong, often pine-like and sweet.	Sap odour much weaker and usually rather acrid.

TAXONOMY

The original aim of the investigation was to elucidate the status of *H. hibernica* hort. When tetraploids were found to be widespread in the wild, the question arose as to what was the relationship between the morphologically very distinct tetraploid, *H. hibernica* hort., and the wild tetraploids which previously would have been included within *H. helix*. The agreement in trichome characters between *H. hibernica* hort. and the wild tetraploids led us to believe that the cultivated plant might be a clone or group of clones of the wild tetraploid. However, the so-called Irish Ivy was unusual in its uniformly large leaf size and non-climbing habit, contrasting with the variable leaf size and normal climbing of most of the wild tetraploids. On the Isle of Wight wild tetraploids were discovered producing some leaves identical to those of the cultivated plant, and in Herefordshire at

Symonds Yat, colonies of wild ivies were found almost a match to *H. hibernica* hort. The Isle of Wight plants bear the Irish Ivy leaves on shoots in transition from the vegetative to the flowering (mature) state. Most of the wild tetraploids produce leaves of this type, but the Isle of Wight samples were most pronounced.

It therefore seems that the cultivated Irish Ivy is a clone, or group of similar clones, stabilised in the semi-arboreal condition. It resembles the creeping/juvenile phase in having pliant stems bearing some of the specialised attaching roots, but these are less numerous than normal in juvenile ivies. The stems run along the ground, sometimes climbing walls and more rarely trees, and cuttings root very readily. The chief similarities to the arboreal phase are in the reduction of the ability to cling and thus to climb, due to fewer adhesive roots, and the broader leaves with shorter, wider lobes. When it does climb it can mature into the flowering condition with radially symmetrical shoots of brittle wood, totally lacking rootlets and having entire leaves. Seedlings are very like the parent, but do seem more ready to climb, and, like it, have rather larger and broader leaves than is typical for the younger stages of wild tetraploids. Similar observations have been made in Germany (G. Grüber, pers. comm.). *H. hibernica* hort. therefore probably consists of a clone or clones from the south of England. Horticulturalists have long been aware of slight variation in *H. hibernica* hort. Some clones are darker in the foliage or are not glossy, and another clone has more sharply lobed leaves than normal. In the main, however, it is uniform. Variegated sports occur, including 'Variegata', 'Sulphurea', 'Marmorata' and 'Rona'. Also, seedlings may arise by self-fertilisation.

The present situation is that there are diploids and tetraploids normally referred to *H. helix*, with a tetraploid cultivar being called *H. hibernica* hort. or *H. helix* subsp. *hibernica*, a name that has become current in horticulture, and that has recently been validated nomenclaturally (McClintock 1987). At what taxonomic level should they be recognised? As they differ in ploidy level, geographic distribution, distinctly in one morphological, albeit cryptic, character, and in other less obvious ways, we consider it desirable to distinguish them as separate species. We are aware that this decision may be controversial as many would prefer to recognise them as subspecies (cf. Lum & Maze 1989). If *Hedera* were an obscure genus known to few we would perhaps have concurred. However, it is very well-known to botanists and gardeners and there are numerous cultivars, so that the use of subspecies would lead to long clumsy horticultural epithets and possibly to the ignoring of distinction between the subspecies. The level of subspecies is well suited to situations where geographical or ecological variants exist at the same ploidy level, as with *Betula pubescens* Ehrh. (Walters 1964), or where cytotypes are not easily or always distinguishable, as in *Asplenium trichomanes* L. (Crabbe *et al.* 1964) or *Galium palustre* L. (Clapham 1962). However Ehrendorfer & Puff (1976) treat *G. elongatum* C. Presl as a separate species, despite the admission that intermediates occur with *G. palustre* L. We consider that the situation with British ivies is more like that found within the *Dryopteris dilatata* complex, in which northern diploids have been distinguished as *D. expansa* (C. Presl) Fras.-Jenk. & Jermy (*D. assimilis* S. Walker) and are differentiated from the tetraploid, *D. dilatata* (Hoffm.) A. Gray, primarily by a cryptic spore character, but also by a not very easily defined morphology.

Linnaeus' specimens consist of at least four samples of *Hedera helix*, three of which are too mature for certain determination and for this reason specimen 280.2 in **LINN**, which has a sterile shoot and typical diploid trichomes, is here selected as the lectotype. Thus *H. helix* may be retained for the diploids. The earliest name for the tetraploid is probably *H. hibernica* hortul. (De Candolle 1830), a nomen nudum as there is no description. The first mention with a description is by Kirchner in Petzold & Kirchner (1864) as "*H. helix* var. *hibernica* hort. Schottischer Epheu". In 1914 Bean raised this taxon to specific rank as *H. hibernica* (Kirchner) Bean. Thus *H. hibernica* is the name which now must be used for the tetraploids (McAllister 1981), the cultivated clone becoming *H. hibernica* (Kirchner) Bean cv. Hibernica.

Most ivy cultivars are referable to *H. helix*, but some others, as well as cv. Hibernica, belong to *H. hibernica*, including 'Digitata', 'Deltoidea', 'Variegata', 'Maculata', 'Albany', 'Hamilton', and 'Helford River' (Lawrence & Schulze 1942; Rose 1980, 1983; Grüber 1983; Sulgrove 1981a & b). The semi-adult nature of *H. hibernica* hort. is paralleled in *H. helix* by a remarkable clone collected at South Glendale in the south-west of South Uist in the Outer Hebrides. This looks superficially like cv. Hibernica but has leaves from 6 cm wide by 5 cm long to 12·5 cm wide by 9 cm long; the texture is thinner than that of the Irish Ivy however, and the margins have the typical undulations of maturing juvenile leaves of *H. helix*.

SYNONYMY

The synonymy of most ivies in cultivation and their cultivars is given in Lawrence & Schulze (1942), but is summarised here with *H. hibernica* treated as a distinct species.

1. **H. helix** L., *Sp. Pl.* 202 (1753). LECTOTYPE: sheet 280.2 (**LINN**), designated here. Common Ivy.

2. **H. hibernica** (Kirchner) Bean, *Trees & shrubs hardy in the Br. Isl.* 609 (1914). Atlantic Ivy.
H. helix var. *hibernica* Kirchner in Petzold & Kirchner, *Arb. Muscav.* 419 (1864).
H. hibernica Carr. in *Rev. Hort.* **71**:163 (1890), nomen nudum.
H. helix subsp. *hibernica* (Kirchner) D. McClintock, *Suppl. wild fl. Guernsey* 23 (1987).

We propose the common name Atlantic Ivy for *H. hibernica* in the wild state and suggest restricting the use of Irish Ivy to the cultivar Hibernica.

PHYTOGEOGRAPHY

The distribution of *H. hibernica*, the Atlantic Ivy, is very similar to that of certain heaths, *Erica cinerea* having a slightly more extensive range, while *E. vagans* and *E. mackaiana* have progressively more limited ranges, and *E. ciliaris* extends further south into Morocco. It is interesting that although these heathers belong to totally different types of community from the ivy, all are evergreen and so subject to the same freezing and desiccation stresses in cold winters which presumably limit their eastward spread. They, together with the more widely distributed *H. helix* and *Ilex aquifolium*, are among the very few larger evergreen flowering plants native to northern Europe.

The distribution of the two species in the British Isles shows *H. helix* with an almost continuous distribution and *H. hibernica* in somewhat separate areas on the western coasts. This pattern suggests that *H. hibernica* formerly had a more extensive, continuous range which has been reduced by *H. helix* invading from the south-east. In milder, wetter parts of the country it seems that *H. hibernica* can occupy the available habitats and hold off the advance of *H. helix*. In less mild areas the occasional exceptional cold spell may do sufficient damage to *H. hibernica* to leave niches free for colonisation by the more winter-hardy *H. helix*. *H. hibernica* occurs in the south-west of England, most of southern and western Wales and the northern Welsh coast. There is an isolated record for Silverdale in northern Lancashire and extensive isolated populations occur in the mild coastal parts of Galloway in south-western Scotland. Only *H. hibernica* has been found on the Isle of Man, and the distribution of the two species in Ireland might suggest that *H. helix* has only recently invaded from Scotland, from the Mull of Kintyre, and may be extending its range. The situation on the main island of Great Britain could be expected to have more or less stabilised for present climatic conditions, but it will be interesting to watch what happens following a succession of cold winters.

ORIGIN OF *H. HIBERNICA*

H. hibernica is here classified with *H. helix* and *H. azorica* Carriere (*H. canariensis* 'Azorica' hort.) because it has the same long, white-rayed trichomes. It differs from these diploid species in that its rays lie more or less appressed to the leaf surface, in a similar way to the rays of the other much larger grouping of ivy species, the orange-red, small-haired species of *Hedera*, found mostly to the south and east of the Mediterranean and Black Seas (McAllister 1981). There is the possibility therefore that the tetraploid *H. hibernica* could be an allotetraploid derivative of *H. helix* and a species from the second group. In North Africa, in the Atlas Mountains, there is an as yet undescribed diploid with large five-lobed ivy-shaped leaves and considerable vigour which seems an ideal candidate. *H. hibernica* resembles this species in its capacity to produce larger leaves than those of *H. helix*, in the greater average number of rays per trichome and the fawn to slightly orange colouration of the central boss of the trichomes of some populations, as well as the attitude of the

rays, the sweeter sap odour found in the larger group of ivies and the more luxuriant growth. *H. hibernica* is thus intermediate in several characteristics between *H. helix* and the undescribed species from Morocco.

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REFERENCES

Bean, W. J. (1914). *Trees and shrubs hardy in the British Isles* **1**: 609. London.
Clapham, A. R. (1962). *Galium* L., in Clapham, A. R., Tutin, T. G. & Warburg, E. F. *Flora of the British Isles*, 2nd ed., pp. 782–783. Cambridge.
Colgan, N. & Scully, R. W. (1898). *Contributions towards a Cybele Hibernica*, 2nd ed., p. 160. Dublin.
Crabbe, J. A., Jermy, A. C. & Lovis, J. D. (1964). *Asplenium* L., in Tutin, T. G. *et al.*, eds. *Flora Europaea* **1**: 14–17. Cambridge.
De Candolle, A. P. (1830). *Hedera. Prodr. Syst. Nat. Reg. Veg.* **4**: 261. Paris.
Druce, G. C. (1912). *Hedera helix* L. var. *sarniensis* Druce. *Rep. botl Soc. Exch. Club Br. Isl.* **3**: 163.
Dyer, A. F. (1963). The use of lacto-propionic orcein in rapid squash methods for chromosome preparations. *Stain Technol.* **38**: 85–90.
Ehrendorfer, F. & Puff, C. H. (1976). *Galium* sect. *Aparinoides*, in Tutin, T. G. *et al.*, eds. *Flora Europaea* **4**: 21. Cambridge.
Grüber, G. (1983). *Merkmale Anbau und Verwendung Winterhalter* Hedera *Arten und Sorten*, pp. 75–87. Geisenheim.
Hibberd, S. (1872). *The Ivy: a monograph*, p. 27. London.
Hooker, J. D. (1870). *Students' Flora of the British Islands*, p. 172. London.
Jacobsen, P. (1954). Chromosome numbers in the genus *Hedera* L. *Hereditas* **40**: 252–254.
Lawrence, G. H. M. & Schulze, A. E. (1942). The cultivated Hederas. *Gentes Herb.* **3**: 142–144.
Lum, C. & Maze, J. (1989). A multivariate analysis of the trichomes of *Hedera* L. *Watsonia* **17**: 409–418.
McAllister, H. A. (1981). New work on ivies. *Int. Dendr. Soc. Year Book* **1981**: 106–109.
Mackay, J. T. (1836). *Flora Hibernica*, p. 135. Dublin.
McClintock, D. (1987). *Supplement to the wild flowers of Guernsey*, p. 23. St. Peter Port.
Petzold, E. & Kirchner, G. (1864). *Arboretum Muscaviense*. Berlin.
Rose, P. Q. (1980). *Ivies*, pp. 114–118, 147–148. Poole.
Rose, P. Q. (1983). 'Hibernica'. *The Ivy, J. Br. Ivy Soc.* **6**(1): 34–35.
Rutherford, A. (1979). The B.S.B.I. Irish Ivy survey. *B.S.B.I. News* **22**: 8–9.
Sulgrove, S. M. (1981a). The variegated Hibernicas. *The Ivy Bull.* **7**(4): 29–34.
Sulgrove, S. M. (1981b). Nomenclatural analysis of the variegated Hibernicas. *The Ivy Bull.* **7**(4): 35–39.
Walters, S. M. (1964). *Betula* L., in Tutin, T. G. *et al.*, eds. *Flora Europaea* **1**: 57–58. Cambridge.

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Detection of protandry and protogyny in Sycamore (*Acer pseudoplatanus* L.) from infructescences

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ABSTRACT

In Sycamore (*Acer pseudoplatanus* L.), trees may be protandrous when their inflorescences start with a sequence of male flowers followed by a sequence of female flowers, or protogynous when the reverse sequence occurs. The sex expression on an inflorescence may change more than once and, in Ireland, five modes of sex expression have been observed. When studying such heterodichogamous species it is essential to determine their sexual morphs. A method to sex Sycamore using infructescences only is described. Using a variety of characters such as fruit size, percentage parthenocarpy, infructescence length, size of terminal bud scar and position of the fruit on the first secondary axis, it is possible to distinguish between protandrous and protogynous individuals.

INTRODUCTION

In Sycamore, *Acer pseudoplatanus* L., all flowers are functionally unisexual and appear sequentially on a single inflorescence. When male anthesis takes place before the stigmas become receptive, the inflorescence is described as protandrous, and is protogynous when the reverse sequence occurs. Likewise individual trees may be either protandrous or protogynous. Such a sexual dimorphism is called heterodichogamy (Stout 1928). On a single inflorescence the sex of sequentially opening flowers may differ more than once in time, and de Jong (1976) described eleven different modes of sex expression within an inflorescence, of which five have been observed in the north of Ireland (Fig. 1).

Protogynous individuals will produce inflorescences of Mode B and very rarely a few of Mode G. Protandrous individuals are far more variable as they have inflorescences of Mode C, D, or E, or a mixture of these. Male-flowering trees are described as protandrous because in some years some or even all their inflorescences have female flowers. Similarly protandrous individuals will exhibit large annual variation in the proportion of inflorescences of Mode C, D, and/or E (de Jong 1976). Scholz (1960) has reported the existence of female-flowering individuals. There is no evidence that trees will change their modes of sex expression with age.

In heterodichogamous species certain characters, such as fruit production, percentage of fertilized fruits and the number of carpels per fruit, may vary between morphs (Binggeli, unpublished). In order to explain such variations it is then essential to know the sexual morph of the trees studied. Because sexing the flowers of trees in spring is rather time-consuming and/or impractical on tall specimens, a method using the morphological characters of the infructescence was developed.

RELIABILITY OF METHOD

The method for the identification of the sex expression of the inflorescences using infructescences was developed in 1983, and was tested with 95% success when comparing the flowering data of 240 trees obtained in spring and the determination of the sex expression using infructescences in the autumn. The test was repeated in 1984 with 100% success.

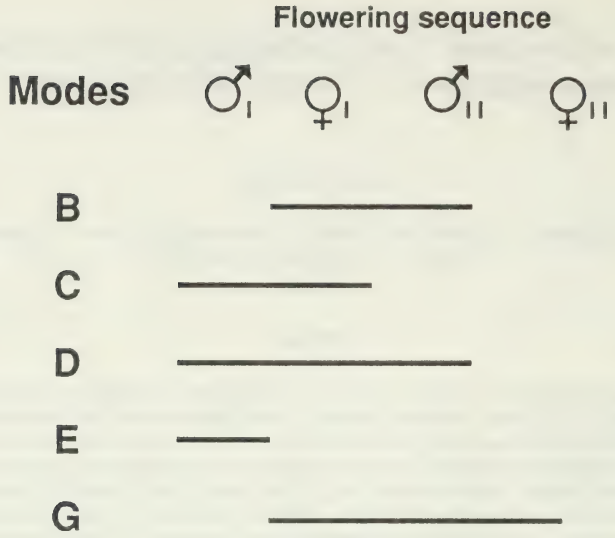

FIGURE 1. Modes of sex expression observed on Sycamore inflorescences in the north of Ireland. Flowering sequences are represented by male (♂) and female (♀) type flowers. A roman numeral subscript one (I) represents an initial flowering period, a roman numeral subscript two (II) a subsequent flowering of the same type. Modes according to de Jong (1976).

DESCRIPTION

Using fruiting material only, one can differentiate between protandrous and protogynous individuals and also between infructescences of Mode B and Mode G of the latter group using the characters listed in Table 1 and as shown diagrammatically in Fig. 2. In Mode G the structure and position of the fruits of the first part of the stalk is similar to the normal protogynous infructescence (Mode B), but it is longer and it bears a few small parthenocarpic fruits at its end (Fig. 2C). It is, however, impossible to distinguish between infructescences from Mode C and D. The very few male-flowering individuals (Mode E; less than 1% in Ireland) will not be recognised with this method and only the shoot morphology will provide indications of their existence. In these, soon after flowering,

TABLE 1. MORPHOLOGICAL DATA FROM INFRUCTESCENCES DIFFERENTIATING BETWEEN PROTANDROUS AND PROTOGYNOUS INDIVIDUALS, AND ALSO BETWEEN MODE B AND MODE G OF THE LATTER GROUP

		Protogynous	
Character	Protandrous	Mode B	Mode G
Fruit size (length of samara in cm)	2·5–3·5	3·0–4·0	3·0–4·0 & (1·5–2·5 terminal)
Parthenocarpy[a]	30–90%	10–40%	10–40%
Length of infructescence	>10 cm	<10 cm	>10 cm
Terminal scar (diameter in mm)	0·5–1·0	1·0–2·0	0·5
Position of fruit on 1st secondary axis	On a tertiary axis (2nd axis ends with a scar)	Usually diagonal Terminal	Terminal

[a] Parthenocarpy is assessed as the percentage of empty samaras. In the field they are recognized by their smaller size and also by their distinctly empty nutlet.

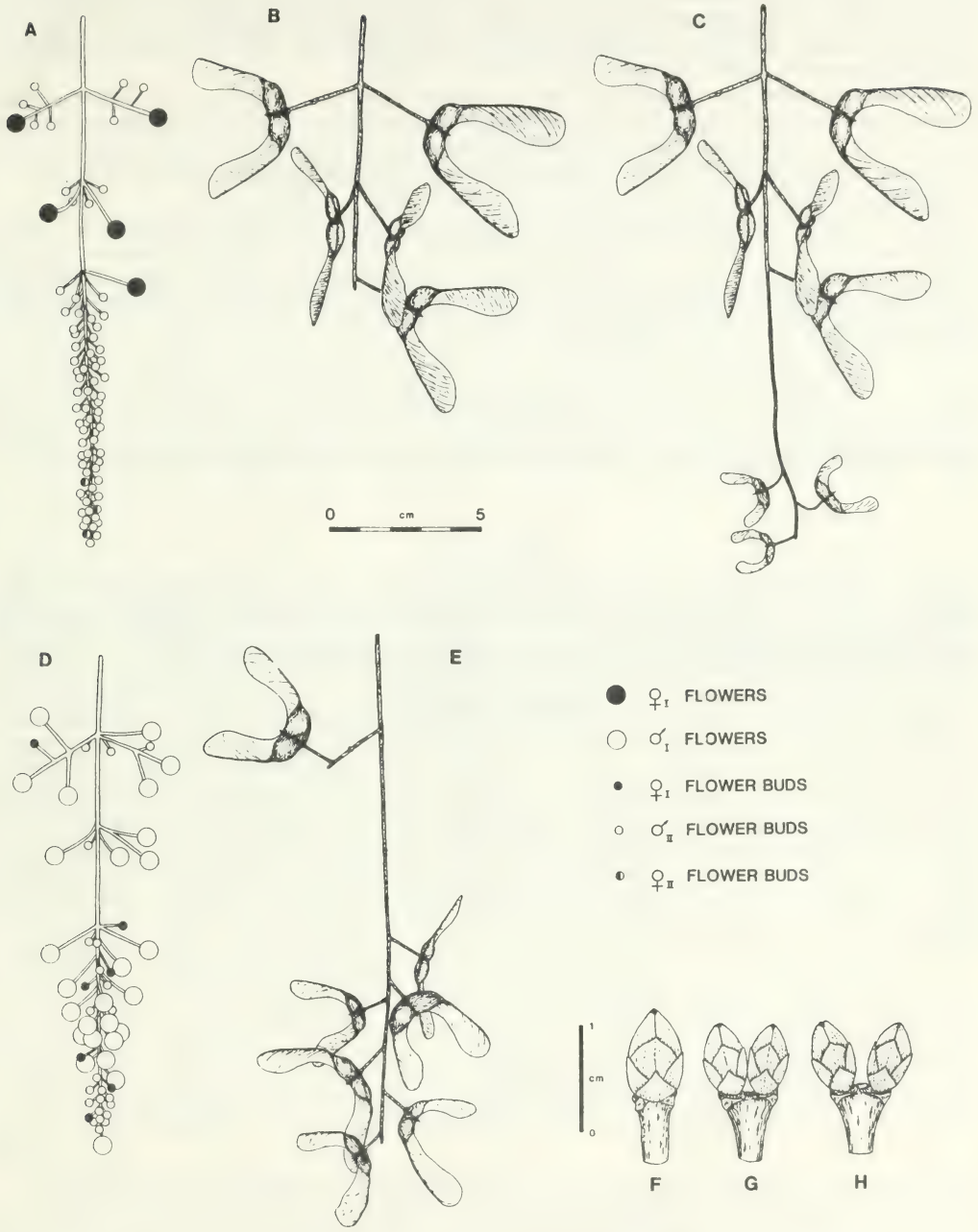

FIGURE 2. Architectural differences between protandrous and protogynous inflorescences and infructescences (see Table 1 for other diagnostic features) and shoot morphology after leaf and infructescence fall in Sycamore. A, Protogynous inflorescence ($♀_{II}$ flowers (◐) of Mode H are $♂_{II}$ in Mode B (○)). B, Protogynous infructescence, Mode B. C, Protogynous infructescence, Mode H. D, Protandrous inflorescence. E, Protandrous infructescence. F, Vegetative shoot. G, Flowering shoot (Mode E). H, Fruiting shoot (Flowering Modes B, C, D, & G).

the inflorescences will fall and the two growing terminal buds will be closely appressed (Fig. 2G). On the other hand in other modes of flowering, female flowers, even if unfertilized, will produce fruits, because of a high parthenocarpic tendency in maples. Such infructescences will remain on the trees most of the summer leading to two well separated terminal buds (Fig. 2H). It should be noted that some small flowering side shoots may not produce any buds.

Only practice allows one to determine the sex expression of the individual with accuracy from infructescence material, and whilst the majority of the individuals examined fit easily into one or other of the two morphs, nevertheless some trees have features which do not always fit entirely the description given in Table 1 and Fig. 2. For instance some infructescences of Mode B do have a terminal fruit, but this is never the case for protandrous modes of flowering.

The size of fruits and infructescences, and the number of fruits per infructescence given in Table 1 are applicable to Sycamores encountered in most of the British Isles and the Alps. However in areas with a very favourable climate (e.g. some parts of lowland Switzerland) measurements of fruit and infructescence size and the number of fruits per infructescence may be higher, and therefore the values listed in Table 1 may be misleading.

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REFERENCES

Jong, P. C. de (1976). Flowering and sex expression in *Acer* L. *Meded. LandbHoogesch. Wageningen* **76**: 1–201.
Scholz, E. (1960). Blütenmorphologische and biologische Untersuchungen bei *Acer platanoides* L. und *Acer pseudoplatanus* L. *Züchter* **30**: 11–16.
Stout, A. B. (1928). Dichogamy in flowering plants. *Bull. Torrey bot. Club* **55**: 141–153.

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The *Rubus* flora of the Isle of Wight

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ABSTRACT

Fifty-nine named microspecies of brambles (*Rubus fruticosus* L. agg.) are reliably recorded from the Isle of Wight (v.c. 10). Four of these are of alien status. Separated from Hampshire by a strait nowhere wider than 8 km, the island nonetheless diverges markedly from that county in its *Rubus* flora. Five species with British Isles ranges that are strongly western are known in Wight but not in Hampshire; six other species occur in the island relatively more plentifully. More strikingly, Wight lacks three of Hampshire's commonest and most generally distributed species, a fourth having arrived in its sole locality apparently only recently. Conspicuous absentees are also to be found in the groups of species the island shares respectively with the Bournemouth and Southampton districts. A slighter affinity with Sussex is seemingly the product of a late infiltration.

INTRODUCTION

The Isle of Wight (v.c. 10) can be expected to be peculiarly rewarding to the student of the *Rubus fruticosus* L. aggregate. Its 381 km^2 are patently a broken-off fragment of Hampshire (of which up to 1890 it formed part administratively) and in that county this group attains probably its greatest diversity in the British Isles, on account of its southerly position and the overlap there of the rich *Rubus* florulas of the south-east and the south-west of England. How far the more widespread brambles of Hampshire are represented in Wight, and vice versa, thus constitutes a valuable test of the extent to which a comparatively narrow stretch of water (nowhere wider than 8 km) acts as a barrier to dispersal in this genus. This water barrier is known to have been in place since early in the Flandrian, for marine deposits on both sides of the Solent, dated on the basis of the pollen content of overlying peats, indicate that the present coastline was attained at least by 7,000–8,000 B.P. (Devoy 1987). Apart from a perhaps rather limited number of *Rubus* species that were present at the time of the severance, therefore, and the four which give evidence of having been introduced recently through human agency, the majority of the brambles to be found in the Isle of Wight today must either have had their origin within the island, as the products of local crosses, or been brought in over the centuries by berry-eating birds (not necessarily, of course, only from England).

The period since the severance is too short for any significant degree of endemism to have developed in the island's 'macro' flora and fauna. Nor are the 'macro' flora and fauna sufficiently different in their composition from those of Hampshire to afford much scope for biogeographical comparison. It is on to microspecies, consequently, that one is forced to fall back to find ample indications of divergence; and *Rubus* far surpasses all other lowland groups of these in the richness of its diversity combined on the whole with freedom from any suspicion of introduction through human agency.

Comparative study is rendered far from straightforward, however, by major ways in which the two counties differ physically, most notably in their geology – apart, that is, from the obvious facts that Wight is an island, only one-tenth as large and crucially that much further south. Hampshire, broadly speaking, is a belt of chalk sandwiched between two belts of gravel and thus for the most part hospitable to this mainly calcifuge group of plants. By contrast, fully half of Wight consists of clay and chalk and only the Lower Greensand which occupies the southern third is out-and-out '*Rubus* country'. And even that smaller amount of potentially suitable terrain is deceptive, for most of the natural woodland the island formerly possessed has been lost and the few considerable expanses of acid ground which were still surviving until the late 19th century have either greatly

diminished or disappeared altogether. Away from the south-eastern corner, productive localities tend now to be isolated 'oases'; and there would be fewer even of those were it not for the fact that several of the chalk downs have a cap of gravel, and harbour as a consequence plateau heaths which in certain cases are quite extensive and sufficiently out of the way to have escaped elimination by modern farming pressures.

HISTORY OF *RUBUS* INVESTIGATION IN WIGHT

Fortuitously, Wight was the scene of one of the very earliest investigations of *Rubus* in Britain. This was in the 1840s, at the hands of Thomas Bell Salter, a physician who settled in Ryde in 1839 and brought with him an interest in the group already kindled on the Dorset heaths around his boyhood home at Poole (Salter 1839). Unfortunately, in common with all other specialists in the genus at that period, he interpreted the species far too broadly and his published records (Salter 1845, 1848, 1856) are consequently of all too limited use. On the other hand numerous specimens collected by him survive, mainly in **BM** and **E**, with a few also in **CGE**, **SLBI** and W. Borrer's herbarium (**K**). Most of these have proved to be redeterminable, though regrettably they do not include some of the entities which he over-optimistically identified with species figured and described by Weihe & Nees (1822–27). C. C. Babington held Salter's work in high regard and twice paid him visits, on the second occasion, in September 1846, collecting with him in the field (Babington 1897). He was particularly impressed by an eglandular bramble with large white flowers, which Salter sent him from a wood near Shanklin, and named it *R. salteri* in his honour. That action was in one way unfortunate, for the species appears to be endemic to just this one locality; but on the other hand the existence of this taxon served through the years to lure subsequent students of the genus to the island (though some of them, like W. C. Barton in 1932 and N. Douglas Simpson in 1938, seem to have paid no more than a fleeting visit for the sole purpose of collecting this one species).

Between Salter's time and the present only three other workers sampled the group in Wight at all widely. Two of these, J. G. Baker on a short visit in 1868 (records published in More 1871), and F. Townsend during the 1870s, while compiling the first edition of his Flora of the then single county (Townsend 1883), were Babingtonians taxonomically and in too many cases it is impossible to be sure to which present-day species their names relate. For, unlike Salter's, hardly any of their specimens seem to have survived – none of the 50 or so variants which Baker claimed to have seen (including "*R. fuscoater*" and "*R. rosaceus*", with localities tantalisingly cited) and only two of Townsend's (now in **SLBI**). The third worker, however, was the unrivalled authority of the post-Babington era, W. Moyle Rogers, who came over from his home in Bournemouth for a week in 1901 and was guided to a goodly range of the likeliest habitats by the island's then leading resident botanist, F. Stratton. The 14 taxa added as a result (Rogers 1902) were the first determined in line with subsequent interpretation of the genus and therefore the first whose identities are for the most part unambiguous. Unfortunately, though, no voucher specimens appear to have been kept of some of the newly-recorded species (two of which have not been rediscovered).

After Rogers the island's brambles were effectively ignored until 1974. In that year I made the first of a succession of visits, several of a week in duration, in the course of which I have explored most of the more promising ground systematically. I am indebted to A. Newton, who paid a week's visit himself in 1977, for much assistance with determinations throughout this period. My voucher material (including for all new vice-county records) has been deposited in **RHMC** and in certain cases in **BM** as well.

SPECIES RECORDED

The order and nomenclature in the systematic list that follows are those of Edees & Newton (1988). Unless otherwise indicated, habitats are as stated in that work. A number in brackets after a specific name is the total of 10-km grid squares in which the species has been recorded (maximum 10). An asterisk (*) denotes an addition made to the vice-county list in the period 1974–88, including redeterminations of older material, and † a species introduced to the island exclusively by human agency ('alien').

[*R. DIVARICATUS* MUELLER
The Wilderness, *Rogers*. Near Lynn, *Salter*. Both records need confirmation.]

R. FISSUS LINDLEY (1)
Apparently extinct. Hyde, near Shanklin, *Rogers*. A species that is still quite plentiful in parts of the New Forest.

R. NESSENSIS W. HALL (4)
Rare. Still in small quantity in America/Apse Castle Woods, where Salter (**BM,E**) knew it in abundance; also in Youngwoods Copse, in two places in its detached fragment to the west. The Wilderness, *Rogers*. Freshwater Marsh; Parkhurst Forest, *Townsend*.

R. PLICATUS WEIHE & NEES (5)
Less widespread than formerly, but still relatively plentiful on moist acid alluvium in The Wilderness and at the southern end of Munsley Moor; also on dry heathy ground on Bleak Down, Staplers Heath, Bonchurch Down and (a single bush) in Parkhurst Forest.

R. SULCATUS VEST (1)
Apparently extinct. Alverstone Copse, 1847, *A. J. Hambrough*, as *R. suberectus* (**CGE**, det. B. A. Miles). Near Alverstone, "non rare in dumetis humidis", 1838, *W. A. Bromfield*, as ?*R. plicatus* (**E**). The localities are presumably one and the same.

R. VIGOROSUS MUELLER & WIRTG. (5)
Formerly widespread, now rare. Golden Hill Park, Freshwater, a large colony (with *Viola lactea* Sm.); Headon Warren, one bush, 1981, old pasture at south-eastern corner of Walter's Copse, Newtown; hedge-top at cross-lanes north of Bleak Down (40/514.832); also until c.1978 (when eliminated by ploughing) plentiful among gorse outside Mount Farm Copse, Ningwood. Some of its former localities – Easton Marsh, *A. H. Wolley-Dod*; Colwell Heath, *Rogers* (**SLBI**) – have been altered out of recognition, but it is unclear why it seems to have disappeared from three others from which Rogers recorded it: Niton Down ("in great quantity", 1883, **CGE**), Bleak Down and Parkhurst Forest. Further early records are: between Freshwater and Yarmouth, 1889, *T. R. A. Briggs*; King's Quay Copse, near Osborne, 1869, *Stratton* (**OXF**).

**R. ALBONIS* W. C. R. WATSON (3)
Locally plentiful round Newport: St. George's Down gravel pits, abundant; East Standen Wood, common; Great Briddlesford Wood; Staplers Copse, common; Parkhurst Forest, three bushes. Some of the old records of *R. macrophyllus* Weihe & Nees agg. may refer to this species. It may also have been the *R. schlechtendalii* recorded by Rogers from Marvel Copse, near Newport.

**R. BOULAYI* (SUDRE) W. C. R. WATSON (1)
Rare. Parkhurst Forest, in some quantity in old oakwood in one area at northern end.

**R. ERRABUNDUS* W. C. R. WATSON (2)
Rare. Parkhurst Forest, locally in some quantity; Bohemia grounds; St. George's Down gravel pits, one bush. In all cases not the typical variant (which occurs in one or two places in Hampshire) but the micromorph that is general throughout the New Forest.

[*R. LENTIGINOSUS* LEES
Parkhurst Forest, "apparently this", *Rogers*. I cannot trace any specimen and this is an unlikely locality for this alder carr species, which was formerly interpreted more broadly.]

R. LEUCANDRIFORMIS EDEES & NEWTON (7)
Frequent across the northern half of the island (being tolerant of clay), but almost absent from the south. Particularly plentiful in Whitefield Wood, Brock's Copse, Thorness Wood and Newbarn Copse, Calbourne. Salter's records and specimens (**BM,K**) show that this, rather than *R. lindleianus*, was what he mainly understood by his *R. nitidus*.

R. LINDLEIANUS LEES (8)
Frequent. Particularly plentiful in The Wilderness, Parkhurst Forest and Sticelett Copse. Salter knew this mainly under the name of *R. carpinifolius*: there are specimens of his so determined from three localities (**BM,CGE,E**) and an 1847 one of Hambrough's from a fourth (**CGE**).

R. MOLLISSIMUS ROGERS (1)
Possibly extinct. Bleak Down, in plenty by The Wilderness, *Rogers & Stratton* (**BM**). Also recorded by Rogers from Parkhurst Forest, but abundant and generally distributed there is a similar bramble which I believe to be a distinct, unnamed species ('H252'). I have seen this in many parts of the island and in several places in the far south of Hampshire as well. It is common in the Caricetum paniculatae community in The Wilderness.

**R. OXYANCHUS* SUDRE (2)
Very local: confined to West Wight. Mount Farm Copse, Ningwood, in abundance; Cranmore Wood, a patch; Norton copse, Yarmouth, a patch. Townsend recorded near Shorwell *R. macrophyllus* var. *glabratus*, the name under which he knew this species well in the Bournemouth district, but no specimen has survived and the determination seems unlikely to be correct.

**R. PURBECKENSIS* BARTON & RIDDELSD. (3)
Rare. Staplers Copse, plentiful in an open, once-boggy strip by Blacklands Farm; Parkhurst Forest, two clumps in open heathy area north of Tuckers Gate. Near The Hermitage, St. Catherine's Down 1916, *C. Bucknall*, as ?*R. hirtifolius* (**BRIST**).

R. PYRAMIDALIS KALTENB. (2)
Rare. Borthwood Copse, occasional; Bohemia grounds, one patch. Near Kingston, 1879, *Townsend*, det. Rogers. The micromorph (var. *parvifolius* Frid. & Gelert), the commoner variant in the New Forest, was collected by Miss E. S. Todd in 1926 from a "sandy common between Lake and Horringford" (**BM, SDN**) – which sounds like Apse Heath. By a slip of the pen Miss Todd wrote "between Ventnor . . ." on the **SDN** label, which was transmuted into "below Ventnor" – an impossible location – when the record was published by Rayner (1929).

R. SALTERI BAB. (1)
Rare. Still in some quantity in Apse Castle/America Woods, where Salter originally collected it in 1845, taking it for a tall form of *R. plicatus* (**CGE,SLBI**). Watson (1958) adds "and the downs to the south", but I have not succeeded in finding it there; his assertion that it is "frequent in the south-east of the island" is certainly much too sweeping. A clump of a putative hybrid with *R. vestitus* was found in Apse Castle Wood by Barton in 1932 (*Barton 3788–3795, 3798* (**BM**)). The "*R. salteri*" recorded by Baker from several places in mid-western Wight was clearly *R. leucandriformis*.

**R. ALTIARCUATUS* BARTON & RIDDELSD. (3)
Very local. Blackpan Common, Sandown; Borthwood Copse and hedgebanks to the west, frequent; north end of Apse Heath Copse, one bush; Eastview gravel pits, abundant, and a colony on nearby Bleak Down; Head Down; Shorwell to Berry Hill, frequent along ridge. This may have been the *R. hirtifolius* collected in Apse Castle Wood by Briggs and Rogers pre-1882 and later determined by Rogers and Focke as a form of *R. leucandrus*.

R. AMPLIFICATUS LEES (3)
Occasional. Quarr Wood; Firestone Copse; America Wood; Burnt House lane and copse; Bohemia grounds, frequent around gorse-heath; top of Bonchurch Down. Salter (1856) described it as frequent in woods and thickets, a claim supported by specimens of his from Shore Copse, Fishbourne (**BM,CGE,E,SLBI**), where in his day it was "abundant", and from Brays Hill (**BM**).

**R. BOUDICCAE* A. L. BULL & EDEES (4)
Locally common in the south-east on the Lower Greensand, especially between Newchurch and Sandown, trickling north to St. George's Down and reappearing in quantity way to the west in the Mottistone-Brighstone district. Usually in dry oakwoods or heathy scrub, it is frequent in alder-

willow carr on Blackpan Common. There is a specimen from Sandown in **BM** collected by F. A. Rogers in 1894 (det. Rogers as *R. argentatus*).

R. CARDIOPHYLLUS LEF. & MUELLER (9)
Local; common in some localities, rare or absent in many others. Tolerant of the clay. Widely recorded and collected (mainly as *R. cordifolius*) by Salter.

**R. CORNUBIENSIS* (ROGERS EX RIDDELSD.) RILSTONE (1)
Very rare. Apse Heath Copse and adjoining America Wood, two or three scattered bushes only, 1974 and 1979. Not otherwise known outside Cornwall and Devon.

**R. CURVISPINOSUS* EDEES & NEWTON (3)
Rare. Golden Hill Park, Freshwater, a large colony; Cortheath Firs, on margin of former heath (40/442.901), recurring southwards to Guyers Heath.

**R. DUMNONIENSIS* BAB. (3)
Rare. St. George's Down gravel pits, occasional; hedgebanks west of Borthwood Copse; St. Catherine's Down, two clumps on crest of ridge. Two old records from West Wight – Freshwater, *Rogers*; Headon Warren, above Alum Bay, *Stratton*, det. Rogers – must be treated with reserve in the absence of specimens, as Rogers interpreted this species over-broadly.

R. NEMORALIS MUELLER (5)
Occasional: widely but rather thinly scattered and unexpectedly scarce in very suitable localities (just a single bush in The Wilderness, for instance).

R. POLYANTHEMUS LINDEB. (7)
Local: common in the south-east on the Lower Greensand, but absent from most of the western half of the island. At Shanklin it grows on dry exposed sea-cliffs (as also at Bournemouth).

**R. PROLONGATUS* BOULAY & LETENDRE EX CORBIÈRE (3)
Very local: mainly in the district east of Yarmouth. Mount Farm Copse, Ningwood Common and Cranmore Common, in plenty and becoming abundant near the coast; St. George's Down gravel pits, local; Staplers Copse, one bush.

R. SUBINERMOIDES DRUCE (6)
Common in many of the copses along the northern clay belt, also in Youngwoods Copse, Alverstone, in the south-east; but rare at best in the remainder of the island.

R. SPRENGELII WEIHE (6)
Local. Almost confined to the south-east, where it is still quite widespread; plentiful in at least two heathy woods (Borthwood Copse; Bohemia grounds) and occurs as well on the gravel caps of the higher downs.

**R. ARMIPOTENS* W. C. BARTON EX NEWTON (4)
Very local. Abundant in conifer plantation, Mottistone Common; Head Down, Niton, one bush; Mount Farm Copse, Ningwood; Wootton Bridge, in hedges. This highly disjunct distribution lends support to my impression that this is a recent immigrant: an abundant species of south-eastern England, it is patently adventive in several of the few places in which it occurs in the western half of Hampshire. A. Newton, however, recalls seeing it in several places on his 1977 visit in which it had a natural look and believes it may be of more ancient status.

*†*R. HYLOPHILUS* RIP. EX GENEV. (1)
Very rare. A small patch in Firestone Copse, *Newton*. Apparently introduced with conifers.

**R. LAMBURNENSIS* RILSTONE (5)
A variable bramble, common – in places abundant – in Wight and the adjacent parts of south-west

Hampshire is regarded by Edees & Newton (1988) as conspecific with this Cornubian species. It was collected twice by Salter (**BM**) but not distinguished by him from *R. vestitus*. It is evidently one parent of a distinctive member of Section *Corylifolii* ("H375") that is widespread in the island.

*†*R. PROCERUS* MUELLER EX BOULAY 'HIMALAYAN GIANT' (7)
A fast-increasing escape, already widespread – and even common in Shanklin.

R. ULMIFOLIUS SCHOTT (10)
Very common.

[*R. WINTERI* MUELLER EX FOCKE
A bramble collected by E. S. Marshall in 1891 south-west of Shanklin towards Ventnor (**BM,CGE**) was misdetermined as this by Focke. It is either an unnamed local form or a recent *R. ulmifolius* hybrid.]

R. ADSCITUS GENEV. (2)
Rare. Except for a colony in Barton Wood, above Osborne Bay, confined to West Wight and mainly along its coastal margin. Originally found by Briggs in 1889 on the long-vanished Colwell Heath (**BM**) and at Totland Bay, it still boasts colonies on the cliff north of Colwell Chine and, more surprisingly, among chalk scrub along the inland side of Tennyson Down, where the high oceanicity presumably outweighs the unfavourable geology.

**R. SURREJANUS* BARTON & RIDDELSD. (1)
Very rare. A large colony of the pink-flowered var. *wealdensis* Barton & Riddelsd., otherwise known only in W. Sussex (v.c. 13), in Cook's Copse, north of Newbridge. It has the appearance of a comparatively recent arrival.

R. VESTITUS WEIHE (5)
Locally abundant (as Baker noted), but mainly confined to the clay and chalk. The red-flowered variant seems rare: I have it on record only from Quarr Wood, Ryde.

R. MUCRONATIFORMIS (SUDRE) W. C. R. WATSON (3)
Very local. Abundant in three old oakwood fragments south of Newport: Marvel Copse (a Rogers find, the only locality known up to 1976), copse by Standen House and wooded patch at eastern end of St. George's Down. Otherwise scarce and extremely scattered: Parkhurst Forest, one bush; Beech Copse, Godshill Park; Calloways Farm lane, near Bohemia; top of St. Boniface Down; Mount Farm Copse, Ningwood; Headon Warren.

**R. AEQUALIDENS* NEWTON (2)
Rare. In great abundance on the plateau heath capping St Boniface Down (the highest point on the island) – whence presumably have come recent-looking clumps in Parkhurst Forest, in two places towards the northern end of the main east drive, first noted in 1982.

**R. HANTONENSIS* D. E. ALLEN (3)
Very local. Apse Heath Copse, abundant in northern half in holly wood; St Catherine's Down, in two places; Head Down, Niton, in great profusion even on sunny hedge-tops.

R. LEIGHTONII LEES EX LEIGHTON (6)
Frequent. Thinly scattered over the eastern two-thirds of the island, but locally plentiful in several of the woods, on clay and gravel alike. Unexpectedly, also common along the crest of the ridge from Shorwell to Berry Hill, with *R. altiarcuatus*. Salter knew it only around Ryde, as *R. radula* var. *hystrix* (**BM,CGE,E**).

[*R. MELANODERMIS* FOCKE
Listed by Edees & Newton (1988) for v.c. 10 in error.]

**R. MICANS* GODRON (3)
Local. In most of the clay copses from the Medina valley to Ryde, in several of them plentifully. There is an 1846 Hambrough specimen from Havenstreet in **E** (as *R. apiculatus*). This species seems to be indigenous in Wight, whereas in Hampshire it has everywhere a ruderal distribution and an adventive look.

**R. MOYLEI* BARTON & RIDDELSD. (1)
Very rare. In small quantity in Quarr Wood, Ryde. Too abundant on the opposite side of the Solent for it to be likely that this is other than a recent colonist, even though there is a specimen in **MANCH** (det. Baker, as *R. macrophyllus*) collected on the coast by Quarr Abbey by C. Bailey in October 1888.

**R. CINEROSUS* ROGERS (1)
Rare. Thorness Wood, common at eastern end (on clay) – whence must have come a solitary clump in Parkhurst Forest near Noke Gate.

R. DENTATIFOLIUS (BRIGGS) W. C. R. WATSON (5)
Locally common. Plentiful in woods and on heaths along the south-eastern coastal belt from Sandown to St. Catherine's Down, and up to 6 km inland as far as Godshill and Alverstone; also in the north, in clay copses adjacent to Wooton Creek and in Parkhurst Forest (where it is locally common). It is sad that the new epithet of *vectensis* which Watson bestowed on this species in 1937 has proved to be superfluous, for it was certainly very apt. Watson chose as his lectotype one of several specimens collected by Salter, who, as his determinations (**BM,E,K**) show, was nevertheless badly confused by this variable species.

**R. EFFRENATUS* NEWTON (3)
Very local. In abundance in two widely-separated localities: Blackpan Common, near Sandown, and Head Down, Niton, chiefly among bracken in the open but spilling into the oak hanger, with an outlying patch 1·5 km to the west by The Hermitage. When first collected in 1982, this was taken for a local cross between *R. sprengelii* and some glandular-aciculate bramble. Its identity with this species of north-western Wales, hitherto supposedly endemic there, was only realised and confirmed six years later.

**R. LEYANUS* ROGERS (2)
Very local. Apart from a clump on the top of St Boniface Down above Ventnor, apparently confined to the Brighstone area: abundant in Moortown marshes and copses; Gaggershill Lane, a patch; conifer plantations on Mottistone Common and (*Newton*, 1977, in quantity) Brighstone Down. Probably a recent immigrant: Townsend worked the Moortown locality in the 1870s and recorded nothing resembling this species.

R. BLOXAMII (BAB.) LEES (2)
Very local: apart from two areas of Parkhurst Forest (where Townsend knew it), confined to West Wight, where it occurs in some quantity in all suitable habitats and abundantly in at least three copses.

R. ECHINATUS LINDLEY (8)
Local (rather than "frequent", as Salter described it). Mainly in the northern half of the island, as it tolerates clay and chalk, but, as in Hampshire, very patchy and plentiful only in one or two localities: Whitefield Wood, Guyers Heath and – according to Townsend – downs above Idlecombe.

R. FLEXUOSUS MUELLER & LEF. (5)
So well-marked a species that the failure of Salter, Baker and even Townsend to record it may mean that it has greatly increased, perhaps as the result of extensive felling. Certainly it is now widespread and abundant in several woods (Marvel Copse, Newport; Youngwoods Copse; Thorness Wood; America Wood; Bunkers Copse, Rookley) and, more often than in Hampshire, plentiful even in

two or three places on heathland sheltered by bracken or gorse. It is conspicuously absent from the high-level heaths and I have seen but a single bush in all of West Wight.

R. INSECTIFOLIUS LEF. & MUELLER (2)
Rare. Bunkers Copse, Rookley, locally in plenty; St. George's Down gravel pits, one bush; Parkhurst Forest (where Rogers saw it), in two areas but scarce. Possibly the two records in *Flora Vectensis* for *R. fuscus* Weihe also belong here: Bohemia grounds, *Hambrough*; heathy common about Lynn Farm, *Salter*.

**R. LARGIFICUS* W. C. R. WATSON (2)
Rare. Godshill Park, in abundance; Borthwood Copse, one large patch; Mottistone, in two places. In all cases the Wealden variant, not the pinkish-flowered variant of Hampshire.

*†*R. RUDIS* WEIHE (1)
Abundant in the Rectory shrubberies, Old Shanklin, spilling over into nearby gardens. An obviously accidental introduction, but interesting in showing that this common North Downs species would have thrived had it only chanced to have arrived by natural means.

[*R. RUFESCENS* LEF. & MUELLER
Pan, Newport, *Rogers*. Though common in central and south-eastern England, this becomes a rare species in most of Hampshire and, as Rogers mistook poor material of *R. leightonii* for it in at least two cases, the record is best treated with reserve in the absence of the specimen.]

**R. ANGUSTICUSPIS* SUDRE (1)
Very rare. In quantity along the southern margin of Whitefield Wood, between Ryde and Brading. A species otherwise of south-eastern Wales and the southern Welsh Marches.

†*R. DASYPHYLLUS* (ROGERS) E. S. MARSHALL (1)
Apparently extinct. St. George's Down, 1870, *Stratton* (**OXF**) – presumably an adventive associated with the gravel workings. A fast-spreading colonist from further north in England, this species is unknown as yet in southern Hampshire.

R. PHAEOCARPUS W. C. R. WATSON (3)
Very local. In quantity in certain copses on either side of Wootton Creek (the site of the only pre-1970s record, by Rogers), outstandingly so in Blanket Copse; also on the south coast, scattered over Blackgang Chine and a patch on Rew Down, Ventnor. Perhaps a recent immigrant: this is a species of south-eastern England which is noticeably spreading southwards in Hampshire.

**R. RILSTONEI* BARTON & RIDDELSD. (1)
Very rare. Southern end of Beech Copse, Godshill Park, a large colony mainly growing in shade. When discovered in 1977, this was the first record of this species away from the far south-western part of Britain; but it has since been found at the south-eastern corner of the New Forest.

R. CONJUNGENS (BAB.) ROGERS (4)
Local. Salter knew this as *R. wahlbergii*, finding it chiefly in the north-east. A specimen of his from Bembridge constitutes the lectotype of Babington's variety.

R. NEMOROSUS HAYNE & WILLD. (8)
Relatively more widespread and plentiful than in Hampshire, where it is mainly confined to the New Forest fringes. Locally common in wooded districts on the clay, but also in quantity in places off the clay (Moortown marshes, Brighstone; about Bohemia).

R. PRUINOSUS ARRH. (4)
Frequent. In both chalk scrub and acid woods on the Lower Greensand.

R. TUBERCULATUS BAB. (9)
Common in the coastal areas (e.g. all over West Wight), thinning out inland.

INNOMINATI

As in other counties, numerous bramble bushes are to be met with that cannot be matched with any as yet named species. The majority of these are doubtless the highly localized products of crosses more or less in situ, but several variants occur in quantity over a wide area and some of these may eventually be rated worthy of description. The more noteworthy of the latter are:–

'H257'
A very distinct, densely glandular bramble occurring in great profusion in many of the clay copses between Ryde and Newport and in the south-eastern portion of Parkhurst Forest; also in the far south, in very small quantity, in the roughs on Ventnor golf course and on a wood-margin by Godshill Park House. A shade-lover, it is the Isle of Wight counterpart of Hampshire's *R. glareosus* Rogers. It was collected on the margin of Combley Great Wood ("near Guildford Farm") by Salter and Babington in 1845 (**CGE,E,K**), originally as *R. rosaceus* and later as *R. lejeunei*. There is also a specimen of Hambrough's (woods, Haven Street, 1846) in **E** labelled *R. pallidus*.

'H863'
Misdetermined on different occasions as *R. cissburiensis* Barton & Riddelsd. and *R. babingtonii* Salter (both of which are Hampshire but not apparently Isle of Wight species), this may be a cross between these two species in origin. It completely and abruptly replaces 'H257' in various clay copses on the western side of the Medina valley, recurring in profusion in other substantial pieces of woodland on gravel further west, spilling over here and there into Parkhurst Forest and reappearing, further west still, again in abundance, in Walter's Copse, Newtown. This range is more or less coterminous with the royal hunting park that existed there in medieval times. I have collected the same bramble from a clay copse in central Hampshire, near Steventon (SU/528.483).

'H165'
Abundant in Parkhurst Forest but tightly confined to it. There is a specimen in **SLBI** collected there by Townsend in 1879 labelled *R. pallidus* (subsequently referred by Watson to *R. thyrsiflorus*). This is identical with a bramble long known in parts of West Sussex which has been variously named *R. fuscus* subsp. *obscurus* (by Rogers) and *R. erraticus* (by Watson).

Another unnamed species ('H440'), widespread in the New Forest and long known as *R. leucostachys* var. *angustifolius* Rogers, occurs in one area of Parkhurst Forest. Townsend collected it there too, according to Rogers, who recorded it himself from Bleak Down.

DISCUSSION

The total of 59 named species accepted above as reliably recorded from the island is not particularly impressive when set against Hampshire's 128 species. Even the far more isolated Isle of Man, well to the north in a region of altogether lower *Rubus* diversity, has 34 (Allen 1986). Concealed within the bare figure, however, are some very striking peculiarities.

For a start, Wight has six species that are unknown in Hampshire. One of these is the narrow endemic *R. salteri*, privileged with a name by a mere historical accident, the other five all strongly western species: *R. aequalidens*, *R. angusticuspis*, *R. cornubiensis*, *R. dumnoniensis* and *R. effrenatus*. A sixth species, *R. micans*, might reasonably be added to this list if I am right in my belief that it is not indigenous in Hampshire. *R. angusticuspis* and *R. cornubiensis*, otherwise not known nearer than Gloucestershire and Devon respectively, have the appearance of relatively recent arrivals, but the others have a more established look (though *R. aequalidens* seems to be in the process of producing distant daughter colonies from its large population above Ventnor). Extensive heaths on high ground just inland of the English Channel form a natural halting-place for birds on

passage, and may account for the island having two such unlikely species as *R. aequalidens* and *R. effrenatus*, the former with its headquarters in Pembroke (v.c. 45), the latter, more extraordinarily, known elsewhere only in north-western Wales.

It is the list of absentees, however, that contains the greater number of surprises. Three of the commonest and most generally distributed Hampshire brambles, *R. cissburiensis*, *R. glareosus* and *R. milesii* Newton, are completely missing from its offshore neighbour and a fourth, *R. moylei*, has achieved its solitary foothold probably only recently. There is no apparent reason why all of these should not occur equally plentifully in Wight. Also absent inexplicably are such other widespread Hampshire brambles as *R. bercheriensis* (Druce ex Rogers) Rogers, *R. bertramii* G. Braun, *R. euryanthemus* W. C. R. Watson, *R. platyacanthus* Mueller & Lef. and *R. rubritinctus* W. C. R. Watson. The lack of the last of these is especially remarkable, for it is not only a western species but frequent round most of Southampton Water; the fact that it is not in Wight would seem to imply that it has colonized the coastal zone opposite only comparatively lately. The island's climate may not indeed be as amenable to western species as one is tempted to assume from the presence of, and in some cases frequency of, those particular ones that do occur. *R. adscitus* certainly has the appearance of having only just managed to cling on, restricted till recently to the very extremities, in marked contrast to its wide distribution in Hampshire, while *R. questieri* Lef. & Mueller and *R. longithyrsiger* Lees ex Focke, both locally abundant in the district facing Cowes, are missing from Wight altogether. Nor are the various brambles special to the Southampton region, several of them as yet unnamed, as well represented across the Solent as one would expect from the profusion in which they occur on the adjacent mainland. The unnamed bramble 'H107' (in several places in south-eastern Wight and abundant in Youngwoods Copse, Alverstone) and *R. hantonensis* are the only two that have been found.

Instead of being just an extension of Hampshire, the Isle of Wight is, rather, an amalgam of Dorset and Sussex in the overall character of its *Rubus* flora. As if symbolically, it is with those two other neighbours, indeed, that it shares its most widespread non-Hampshire species, *R. dumnoniensis*.

The Sussex element, admittedly, is small and consists merely of *R. largificus*, *R. surrejanus* var. *wealdensis* and the abundant 'H165' of Parkhurst Forest, all of which have a recent look about them in their Isle of Wight localities; and it is conspicuously without such expectable species as *R. decussatus* W. C. Barton ex Newton (which is present, for example, on Hayling Island) and *R. naldretti* (J. W. White) W. C. R. Watson. In so far as it can be said to exist, therefore, it is probably no more than the outcome of haphazard, late infiltration.

By contrast, the element connecting the island with Dorset – or rather, with the area round Bournemouth – is not only larger, but includes three species which have every appearance of being very long-established: *R. boulayi*, *R. mucronatiformis* and *R. purbeckensis*. Looking more recent, and mainly concentrated in West Wight, are *R. bloxamii*, *R. curvispinosus*, the micromorph of *R. errabundus* and *R. oxyanchus*. Again, though, there is a glaring absentee in the shape of *R. melanodermis* Focke, an absence all the more surprising in view of the frequency of that species on the nearest coast of France, in the district round Cherbourg. *R. subintegribasis* Druce ought to be present too, and perhaps also *R. pullifolius* W. C. R. Watson – though for the latter Milford-on-Sea appears to be the eastern limit in the coastal corridor opposite, which perhaps indicates a limited ability to spread.

Finally, there is a group of species which, while occurring in Wight as well as Hampshire, are relatively more plentiful in the former than in the latter. These are *R. albionis*, *R. amplificatus*, *R. boudiccae*, *R. dentatifolius*, *R. lamburnensis* and *R. vigorosus*. Three of these are western species and in their case the difference may perhaps be attributable to the greater oceanicity of the island's climate. *R. boudiccae*, however, is otherwise known only in the Midlands and East Anglia, so some other factor must presumably be at work to have made Wight so favourable to its spread, perhaps high summer temperatures.

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REFERENCES

ALLEN, D. E. (1986). *Flora of the Isle of Man*. Douglas.

B[ABINGTON], A. M., ed. (1897). *Memorials, journal and botanical correspondence of Charles Cardale Babington*, pp. 128, 138, 439. Cambridge.

DEVOY, R. J. (1987). The estuary of the Western Yar, Isle of Wight: sea-level changes in the Solent region, in BARBER, K. E., ed. *Wessex and the Isle of Wight: field guide*, pp. 115–122. Cambridge.

EDEES, E. S. & NEWTON, A. (1988). *Brambles of the British Isles*. London.

MORE, A. G. (1871). A supplement to the '*Flora Vectensis*'. *J. Bot., Lond.* **9**: 72–76, 135–145, 167–172, 202–211 (*Rubus*, pp. 140–141).

RAYNER, J. H. (1929). *A supplement to Frederick Townsend's Flora of Hampshire and the Isle of Wight*. Southampton.

ROGERS, W. M. (1902). On the distribution of *Rubi* in Great Britain. *J. Bot., Lond.* **40**: 150–157.

SALTER, T. B. (1839). Appendix, illustrative of the botany of Poole and its neighbourhood, in SYDENHAM, J. *The history of the town and county of Poole*, pp. 467–491. Poole.

SALTER, T. B. (1845). Remarks on some forms of *Rubus*. *Ann. Mag. nat. Hist.* **16**: 361–372.

SALTER, T. B. (1848). *Rubus* (pp. 286–287), in BROMFIELD, W. A. Notes and occasional observations on some of the rarer British plants growing wild in Hampshire. *Phytologist* **3**: 205–213, 269–291, etc.

SALTER, T. B. (1856). *Rubus*, in BROMFIELD, W. A. *Flora Vectensis*. London.

TOWNSEND, F. (1883). *Flora of Hampshire, including the Isle of Wight*. London.

WATSON, W. C. R. (1958). *Handbook of the Rubi of Great Britain and Ireland*. Cambridge.

WEIHE, K. E. A. & NEES VON ESENBECK, G. C. D. (1822–27). *Rubi Germanici*. Elberfeld.

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Cornus sericea L. in Ireland: an incipient weed of wetlands

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ABSTRACT

Cornus sericea L. (Cornaceae) has been widely planted in wet habitats in Ireland as an ornamental shrub. It spreads through layering, and has become more or less naturalized at many sites. A list of Irish records is presented. *C. sericea* poses a threat to natural vegetation, especially to wetland woods.

INTRODUCTION

Cornus sericea L., Red Osier Dogwood, a shrub from eastern North America, has also been known as *C. stolonifera* Michx., *Thelycrania sericea* (L.) Dandy and *Thelycrania stolonifera* (Michx.) Pojark. It differs from the native *C. sanguinea* L. in its white fruits, its brighter, usually blood-red twigs, conspicuous in winter, and its 'suckering' habit. *C. sericea* also differs in being adapted to habitats subject to waterlogging, where it has been widely planted as an ornamental. (It is often planted in company with *Salix alba* L. var. *vitellina* (L.) Stokes, Golden Willow, another ornamental whose twigs provide colour during the winter.) *C. alba* L., from northern Asia, is very similar to *C. sericea* but is 'non-suckering' and the stone of the fruit is differently shaped. *C. alba* is reported as an escape in Britain (Moore 1987), but not in Ireland.

MODE OF PROPAGATION AND DEGREE OF NATURALIZATION

Cornus sericea is described by Cook (1968) as "cultivated for ornament and locally naturalized" in Austria, Britain, Finland and Switzerland. It is recorded in several local Floras as naturalized in England and Scotland from Kent (Philp 1982) to Angus (Ingram & Noltie 1981). In Wales, it is recorded from seven counties as an established alien of woodland and scrub (Ellis 1983). It was not included in the standard Irish Flora until the most recent edition (Webb 1977), where it is mentioned as "naturalized in a few places by rivers or in marshy ground". Scannell & Synnott (1987) record it from six Irish vice-counties, on the basis of my site records, all included below. Site records have already been published from West Galway (v.c. H16) (Webb & Scannell 1983) and Limerick (v.c. H8) (Reynolds 1988).

For the compiler of records this species is generally a borderline case: it is rarely quite wild, but it is commonly no longer to be regarded as cultivated. At most sites the species clearly owes its presence to deliberate planting, and the distances that it has spread are limited.

The proportion of flowers that set seed is normally low in Ireland, and I have searched in vain for seedlings at many localities. The increase of the species is very largely by lateral spread, by rooting from decumbent branches. The decumbent branches may grow horizontally at soil level for a few decimetres before turning up to form leafy shoots, which could be mistaken for juveniles derived from seed. This unspecialized form of vegetative reproduction seems best described as 'layering'; the plant is described as "suckering" by Moore (1987) and as "stoloniferous" by Cook (1968). However termed, the process means that a single bush can expand to form an extensive thicket. Vegetative propagation over longer distances may have taken place by means of detached pieces of shoot. A natural means of dispersal would be through the action of rivers in spate. The single bush on Foynes Island in the Shannon estuary (v.c. H8; Reynolds 1988) is the most convincing case for

natural dispersal. The site is not near houses, and there is no evidence of the species having been planted anywhere on the island. The site is within the reach of high tides, and it seems quite possible that a piece of the plant was washed up here, having been torn from the Shannon's banks somewhere upstream (e.g. from the station in Limerick city, v.c. H9). However, I have not found any cases of detached fragments in the process of becoming established, and I conclude that this must be, at best, a rare event.

ANNOTATED LIST OF IRISH RECORDS

The following is a list of all sites of naturalization or incipient naturalization of *Cornus sericea* in Ireland known to me; the records are mine unless otherwise stated.

V.c. H2, N. Kerry: Ross Castle (ruin), S.W. of Killarney, GR V/95.88. Margins of wet woodland close to Lough Leane, spreading by layering, 1972–88, **TCD**; north of Reen Point, S.W. of Killarney, wet woodland, GR V/94.89, 1973–74.

V.c. H8, Co. Limerick: Cappercullin Glen (southern end), Glenstal Abbey (formerly Glenstal Castle), Moroe, between Cappamore and Newport, GR R/73.56, dominant and spreading in wet bottom of narrow glen in old demesne, 1973–86. N.E. of Battery Point, Foynes Island, Shannon estuary, GR R/24.52, single bush about 2·5 m high and 4 m diameter, with many decumbent rooting branches, growing within a few metres of the top of the stony shore just above high water mark, surrounded by large *Salix cinerea* subsp. *oleifolia* and *Rubus fruticosus* agg., 1985–88, S. Reynolds (pers. comm.) and Reynolds (1988). Naturalized by the lakes in Curragh Chase demesne, between Askeaton and Adare, GR R/4.4, August 1985, S. Reynolds (pers. comm.) and Reynolds (1988). Adare, right (east) bank of R. Maigue, GR R/468.466, single small stand beside the bridge, at the foot of a garden, 1986–88.

V.c. H9, Co. Clare: Limerick city between Sarsfield Bridge and the Treaty Stone, bank of R. Shannon, GR R/57.57, medium-sized colony, "suckering freely", April 1985, P. S. Wyse Jackson (pers. comm.).

V.c. H11, Co. Kilkenny: Dysertmore, S.W. of Inistioge, left (eastern) bank of R. Nore, GR S/65.33, single medium-sized colony in low-lying river fringe dominated by *Salix* spp., September 1988. S.W. of New Ross, roadside, GR S/69.26, three small patches in hedgerow, up to 3.5 m high, layering, September 1988.

V.c. H12, Co. Wexford: R. Barrow near Mount Garret Bridge, N. of New Ross, naturalized on the left (eastern) bank, GR S/72.30 – "I have known it there for many years" (S. Reynolds, pers. comm., 1988).

V.c. H14, Laois: Lowlands Wood, Abbeyleix estate, left (eastern) bank of R. Nore, GR S/42.82, locally dominant as an understorey species in alluvial woodland, forming thickets up to 4 m high under canopy of *Quercus robur* L. (less waterlogged sites) and *Salix cinerea* subsp. *oleifolia* (more waterlogged sites), 1972–89, **TCD**; Grantstown (Granston) Lough, between Rathdowney and Durrow, GR S/31.79 and S/31.80; former demesne of Grantstown Manor, wet woodland with many planted species; scattered beds of *C. sericea* fringing lake at northern and south-western ends, also on small island (crannog?) in the middle of the lake, May 1986.

V.c. H16, W. Galway: R. Corrib, western bank, on the N.W. margin of Galway city, large thicket – "It is steadily spreading among native vegetation by suckering, and may by now be regarded as naturalized" (Webb & Scannell 1983).

V.c. H19, Co. Kildare: Donadea Castle (ruin), Staplestown, ornamental lake, GR N/833.329, small stand on marshy lake-margin, "spreading by suckering". 1985, P. S. Wyse Jackson (pers. comm.); 1987, D. L. K. & M. Sheehy Skeffington. Rye Water, Carton demesne, N.E. of Maynooth, wetlands by river and by tributary stream forming boundary with Co. Meath, GR N/95.38, forming dense thickets 2.5–5 m high, spreading by layering; includes an area with shallow braided streams between mud banks, with *Caltha palustris* L. and abundant *Ranunculus ficaria* L. growing under *C. sericea*, March 1987.

V.c. H21, Co. Dublin: 1 km W. of Lucan, left (northern) bank of R. Liffey, GR O/024.352, two small stands c. 10 m apart, the lower branches subject to immersion, backed by deciduous woodland, 1987–89. R. Liffey, both banks, between Lucan and Palmerstown, GR O/05.35, O/05.36, O/07.35, O/08.35, O/09.35, occasional small stands at river margin, the lower branches

subject to immersion, the stands spreading by layering, M. Norton & S. Reynolds (pers. comm.), D. L. K. & M. Sheehy Skeffington, 1988–89. Santry estate, Santry, GR O/408.165, in swampy woodland, growing rampant at the edge of a stream, 1982–86, P. S. Wyse Jackson (pers. comm.). Banks of R. Tolka near Ashtown, GR O/11.37, O/10.37, naturalized along river bank, 1988. M. Norton (pers. comm.)

V.c. H22, Meath: Boyne Canal between Slane and Drogheda, close to the entrance to Townley Hall, GR O/035.755, April 1983, P. S. Wyse Jackson (pers. comm.). Daltonstown House, N. of Balrath (between Slane and Ashbourne), estate woods, GR N/99.66, forming dense thickets in damp cutover deciduous woodland, 1985–88. Rye Water, wetlands by river and tributary stream, Carton demesne (see entry under v.c. H19).

V.c. H23, Westmeath: Clonhugh Woodland, Ballynafid, N. of Lough Owel, GR N/408.604, forming extensive thickets in swampy ground in semi-open woodland, spreading by layering, 1985–86, D. L. K. & S. F. Iremonger.

V.c. H25, Co. Roscommon: Drummans Island (actually a promontory), Lough Key Forest Park (formerly demesne of Rockingham House), southern shore of Lough Key, GR G/84.04, wooded lake-margin, spreading by layering, 1973–86.

V.c. H28, Co. Sligo: near Waterglade Garden, Aghamore, near south-western corner of Lough Gill, GR G/71.32, several bushes by roadside, October 1986. Near Hollybrook House, W. of Lough Arrow, GR G/77.12, small stand in hedge by main road, October 1986.

V.c. H29, Co. Leitrim: south of Clooncoe Lough, near Rinn Lough, GR N/11.91, in wetland wood, spreading from road margin and forming thickets up to 3 m high, May 1984. Near Aghavas, N.E. of Mohill, GR H/1.0 or H/2.0, roadside, spreading by layering, August 1984, D. L. K., D. A. Webb & N. McGough.

V.c. H33, Fermanagh: Crom Castle demesne, S.W. of Derrymacrow Lough, W. of Newtownbutler, GR H/36.24, small stands by side road in conifer plantation, up to 3 m high, spreading by layering (also forming scattered shrubberies in wetland below Crom Castle, clearly planted), June 1987.

V.c. H36, Tyrone: Curran Lough, N.W. of Benburb, GR H/50.54, locally plentiful, 1988, J. S. Faulkner (pers. comm.). Augher Lake, GR H/560.538, 1988, I. McNeill (pers. comm).

V.c. 37, Co. Armagh: Caledon House estate by R. Blackwater, W. of Killylea, GR H/7.4, locally plentiful, 1988, J. S. Faulkner (pers. comm.).

V.c. H39, Co. Antrim: Rea's Wood, fringing Antrim Bay at north-eastern corner of Lough Neagh, GR J/14.85, forming dense thickets up to 4.5 m high in the midst of damp deciduous woodland, spreading by layering (also planted at nearby big house – formerly Skeffington Lodge, now Deerpark Hotel), September 1986, D. L. K., R. Forbes & S. Beesley.

V.c. H40, Co. Londonderry: between Kilrea and Garvagh, several patches and single bushes along a country road, GR C/895.134, C/887.135. "The largest and oldest is a stretch of about 50 metres starting from C895134 in the east"; this originated from "a couple of clusters of say 4 or 5 bushes on the road verge" planted in the 1930s. The bushes do not seem to be spreading, February 1989, D. S. Lambert (pers. comm.). These records are of the yellow-twigged variety, *C. sericea* var. *flaviramea* (Spaeth) Rehd., 'Golden Twig Dogwood'.

ECOLOGY AND AGGRESSIVENESS

Cornus sericea has been widely planted beside ornamental waters in parks and demesnes; it is clearly becoming naturalized at scattered localities throughout Ireland. Records are confined to lowland sites on more or less eutrophic soils, subject to varying degrees of waterlogging. A typical soil profile was investigated beneath a thicket of *C. sericea* in the Abbeyleix estate (v.c. H14, Laois; GR S/419.816), on river alluvium under a canopy of *Salix cinerea* subsp. *oleifolia*. The soil surface was covered by a thin layer of leaf litter and was almost devoid of herbs and bryophytes. The soil was a gley with a wet humus-rich horizon, making a gradual transition at 4–8 cm to a very wet, clayey horizon, grey-brown with orange mottling. The top 5 cm had a loss on ignition of 62% and a pH of 6.8 (1:1 water:fresh soil). Analyses gave total N = 6100 μg ml^{-1} (22,600 μg g^{-1}), C/N quotient = 15.6, total P = 200 μg ml^{-1} (750 μg g^{-1}), available K = 22 μg ml^{-1} (83 μg g^{-1}) and available Ca = 2000 μg ml^{-1} (7450 μg g^{-1}).

For the conservationist, the species is already of considerable significance. It is an aggressive

invader of natural and semi-natural wetland habitats, both open and wooded. Its extensive, dense thickets have no equivalent in our natural vegetation. The pre-existing herbaceous flora is almost totally suppressed, so species-rich communities are converted to species-poor ones. The most serious case known to me is in the alluvial woodland by the R. Nore in the Abbeyleix estate. A substantial portion of this historically important wood (Kelly & Fuller 1988) is now rendered impenetrable by dense thickets of *C. sericea*. The problem is reminiscent of the invasion by *Rhododendron ponticum* L. in woodlands on acid soils (Cross 1982), but the lack of seeding in *C. sericea* means that its control should be relatively straightforward. Ireland's wetland woods are diverse and full of interest; they are, however, sparsely distributed, small in area and subject to various other threats to their survival. Control of *C. sericea* should therefore be a matter of serious concern.

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REFERENCES

Cook, C. D. K. (1968). *Cornus* L., in Tutin, T. G. *et al.*, eds. *Flora Europaea* **2**: 313–314. Cambridge.

Cross, J. R. (1982). The invasion and impact of *Rhododendron ponticum* in native Irish vegetation. *Roy. Dublin Soc., J. Life Sci.* **3**: 209–220.

Ellis, R. G. (1983). *Flowering plants of Wales*. Cardiff.

Ingram, R. & Noltie, H. J. (1981). *The flora of Angus*. Dundee.

Kelly, D. L. & Fuller, S. (1988). Ancient woodland in Central Ireland: does it exist?, in Salbitano, F., ed. *Human influences on forest ecosystem development in Europe*, pp. 336–339. Bologna.

Moore, D. M. (1987). Cornaceae, in Clapham, A. R., Tutin, T. G., & Moore, D. M. *Flora of the British Isles*, 3rd ed. Cambridge.

Philp, E. G. (1982). *Atlas of the Kent flora*. Kent.

Reynolds, S. (1988). Plant records from Co. Limerick (H8). *Ir. Nat. J.* **22**: 533–534.

Scannell, M. J. P. & Synnott, D. M. (1987). *Census catalogue of the flora of Ireland*, 2nd ed. Dublin.

Webb, D. A. (1977). *An Irish Flora*, 6th ed. Dundalk.

Webb, D. A. & Scannell, M. J. P. (1983). *Flora of Connemara and the Burren*. Cambridge.

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The current distribution and abundance of *Orchis ustulata* L. in southern England

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ABSTRACT

Orchis ustulata L. (Orchidaceae) was formerly widespread over much of the calcareous grassland of southern England. Three hundred and seventeen previously recorded sites in 152 separate 10-km squares have been identified, and a survey of the present status of the species at these shows that it has become extinct at many of them, and that there are now only 60 colonies (in thirty one 10-km squares) which definitely survive, only nine of which usually exceed 200 flowering plants. The past and present distribution of *O. ustulata* is illustrated, and some aspects of its ecological preferences and causes of decline discussed. Current colony strengths are indicated and all records traced are presented.

INTRODUCTION

In a previous survey (Foley 1987), the current distribution and abundance of *Orchis ustulata* L. in northern England was reviewed and the causes of its decline discussed. A similar survey of sites in southern England has now been completed and the results are reported below.

O. ustulata is widely distributed throughout central Europe and reaches its northern limit in the island of Gotland, southern Sweden (Ekstan *et al.* 1984), and the Leningrad region of the USSR at 60° N (Meusel, Jäger & Weinert 1965). It is most frequently found in the British Isles on the old, undisturbed chalk and limestone grasslands of southern and south-eastern England at which a light grazing regime has been maintained, and which have not been subjected to agricultural 'improvement'. The species is unrecorded in Ireland and Scotland, and the only record from Wales is almost certainly an error.

The area covered by this survey includes the whole of southern England, namely vice-counties 1–34, 36–40, 53, 55 and 55b, and completes the author's survey of the known distribution of *O. ustulata* within Britain (Foley 1987). The following account is based upon field-work carried out by the author and colleagues, and investigations into old records.

DISTRIBUTION

Three hundred and seventeen recorded sites have been identified in southern England, of which 186 are definitely extinct, a further 24 are possibly so, and 47 are of unknown status but likely to be either small or extinct. These last records are from Wiltshire (v.cc. 7–8) and E. Sussex (v.c. 14), where it has been difficult to trace precisely all of the many records in old Floras and other sources, some of which may duplicate known sites.

The past and present distribution of *O. ustulata* is shown in Figure 1. Out of a total of 152 recorded 10-km squares, this species is definitely present in only 31. The progressive extinction in other squares can be seen in Table 1. The great majority of sites were, and are, on calcareous ground – principally the chalk downs, but also on limestone grasslands. In the past, the highest density of sites was in Wiltshire, Hampshire and Sussex, but good colonies were also known in Dorset, Wight, Kent, Hertfordshire, Berkshire, Cambridgeshire, Bedfordshire, and Gloucestershire.

Even today, the main stronghold of *O. ustulata* is still the chalk downland of N. and S. Wilts.

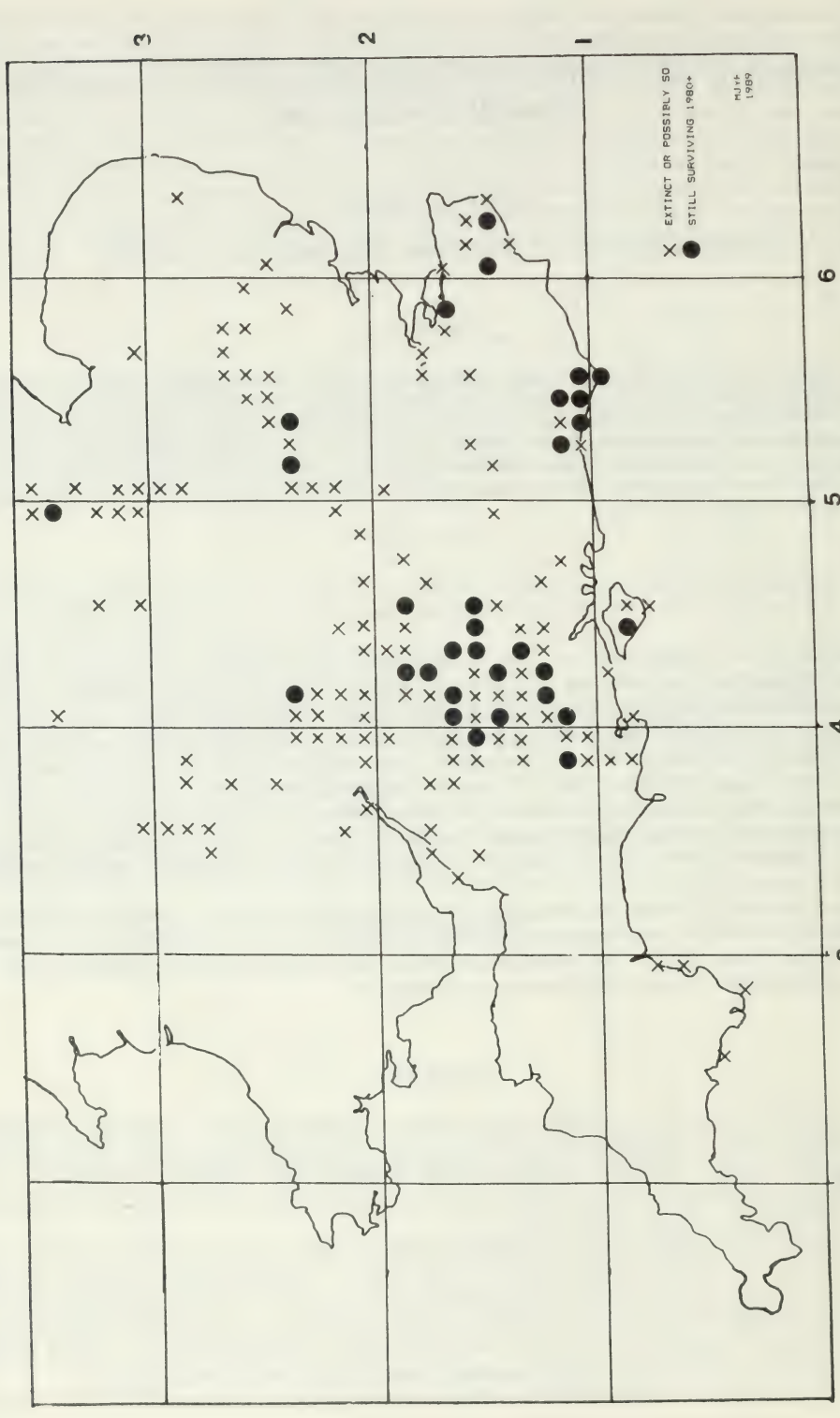

FIGURE 1. The past and present distribution of *Orchis ustulata* in southern England, v.cc. 1–34, 36–40, 53, 55, 55b. Plotted in 10-km squares.

TABLE 1. TIME-SCALE OF THE PROGRESSIVE EXTINCTION OF *O. USTULATA* FROM THE 152 RECORDED 10-KM SQUARES OF SOUTHERN ENGLAND

Extinction Period:–	Date Unknown	Pre-1900	1900–29	1930–59	1960+	Extant	Total number of 10-km square records
Number of 10-km squares	25	55	13	14	14	31	152

(v.cc. 7–8) and E. Sussex (v.c. 14), where the plant survives, often in very strong colonies, on some of those fragments of grazed downland which have escaped modern agricultural upgrading. Many of these are nature reserves or areas of special conservation interest relating to orchids and to chalk grassland plants in general. Unfortunately, and in contrast with many sites in northern England, where steep slopes or outcropping rock has prevented ploughing, most southern sites can be destroyed relatively easily in this way.

In southern England, the western limit of *O. ustulata* was formerly near Wembury, S. Devon (v.c. 3), but the presence of this colony has apparently not been confirmed since 1932. It may be that the small Fontmell Down colony, Dorset (v.c. 9), now represents the western limit of extant sites, which then rapidly increase in number eastwards, with Wiltshire (especially v.c. 8) possessing the largest populations in Britain.

ECOLOGY

O. ustulata is most frequently to be found in forb-rich, moderately grazed calcareous grassland which has been physically undisturbed in the past, and untreated by artificial fertilisers or herbicidal/pesticidal sprays. Fairly constant associates include *Poterium sanguisorba*, *Anthyllis vulneraria*, *Lotus corniculatus*, *Primula veris*, *Rhinanthus minor*, *Polygala* spp., and *Gentianella* spp.. The orchids, *Orchis morio*, *O. mascula*, *Platanthera bifolia*, *Gymnadenia conopsea*, and *Dactylorhiza fuchsii* are frequent associates also, and less often *Coeloglossum viride* and other plants such as *Blackstonia perfoliata* and *Campanula glomerata*.

The usual habitat is on gentle to steeply sloping calcareous ground. This can be of almost any aspect, but is most frequently warm, south-westerly to south-easterly-facing on rather steep-sided hollows, banks, and dry valleys in the chalk downs. Ancient earthworks, by virtue of having remained undisturbed for many hundreds of years, are often a favoured habitat and frequently harbour sizeable colonies. There are, however, very large areas of suitable grassland containing all the species normally associated with *O. ustulata*, but from which the plant is absent, and even some of the largest colonies are quite localized in extent. Only the three strongest located in this survey, each having several thousand flowering plants in a good season, have continuous populations covering an area greater than 1 ha, and many good sites are much smaller, or if not, the plants within them are thinly and sporadically distributed.

What is now probably the finest remaining British colony, consisting of an estimated 3000–5000 flowering plants, is in S. Wilts. (v.c. 8), and lies on gently undulating, multi-aspect downland forming a large continuous population with associated outliers. The site has a well-documented history of traditional grazing and agricultural usage reaching back possibly two millenia and is now fortunately fully protected as a nature reserve. A second very large colony, also in v.c. 8, and estimated at 2000–3000 plants, lies on the very steep west-facing slope of a dry valley and is quite different to the former in topography, and possesses probably the highest concentration of plants (1000+ per ha) of any of these very large sites.

Since the decline of the rabbit population through myxomatosis, the level and timing of managed grazing appears to be critical to the long-term survival of *O. ustulata*. Light grazing, preferably by sheep, from early Spring to the end of April, with a further spell in late July through until September, plus occasional dressings of natural organic manure, seems to be the favoured pattern at sites with the largest populations. This time-scale leaves ample opportunity for flowering and seeding. Cattle grazing, unless very light, may destroy the orchid by trampling or cause damage to

friable turf, thereby allowing the establishment of intrusive colonising plants, and is probably best avoided. Some sites are currently very overgrazed, e.g. Yarnbury Castle (v.c. 8), where small stunted plants, often only 3–5 cm in height, are found. In contrast it has been found (Foley 1987) that the plant can survive in quite rank, ungrazed localities, where tall specimens of 20–25 cm are normal, although survival of such colonies may be for a limited time only, and at least one such colony in northern England appears to have a diminishing number of plants.

In southern England *O. ustulata* has a peak flowering period from late May to early June, after which the plants rapidly senesce, especially if seed has not been set. However, a late-flowering variant flowering in early- to mid-July occurs at several sites forming colonies often quite separate from the earlier-flowering variant, although for example at Willingdon, E. Sussex (v.c. 14), both variants may grow together. Most records of this late-flowering variant are from Wiltshire, Hampshire, and Sussex, where it occurs in relatively close proximity to the earlier-flowering variant, but such colonies seem to comprise comparatively few plants, usually less than 100. Later-flowering variants have been recorded from continental Europe, but are unknown in northern England. Morphologically, there are no obvious differences between the two variants, although late-flowering plants sometimes appear to have darker sepals. In N. Wilts. (v.c. 7), one colony of late-flowering plants lies within 1 km of one of the early-flowering ones, both in a typical habitat for *O. ustulata* and with similar associates. Both also form discrete colonies, and such a difference in flowering period is difficult to ascribe; rather surprisingly, in this case, these late-flowering plants are somewhat smaller than the nearby normal variant. It is possible that heavy Spring grazing over a period of many years, might lead to the development of a late-flowering ecotype, but whatever the reason, it requires further study.

White-flowered variants of *O. ustulata*, referable to var. *albiflora* Thielens, have been recorded in the past from several sites in southern England (see Records), but none were encountered in the course of the present survey, although recently reported from two sites in northern England (Foley 1987).

CURRENT STATUS AND CAUSES OF DECLINE

The current status of *O. ustulata* at each site is denoted below (Records) by the letters: A = typically 1–10 flowering plants; B = 11–25; C = 26–50; D = 51–200; E = 201–1000; F = 1000+; PX = possibly extinct; X = extinct; U = unknown status, but likely to be either small colonies or extinct. Most extant sites and many other recent and less recent ones have been visited by the author and colleagues within the last few years, and estimates of colony size are usually based on observations made over several seasons. Comments relating to the above scale of estimates and to presumptions of extinction have been made previously (Foley 1987) and are equally applicable to the present survey.

Of the 42 vice-counties in the survey area, *O. ustulata* has in the past been recorded from 35, at some 317 separate sites. The present survey has shown the species to be now extinct, or probably so, in 21 vice-counties (Table 2); in a further eight, the number of sites is now reduced to less than 20% of those recorded in the past. In a further three the position is slightly healthier, but even here

TABLE 2. CURRENT STATUS OF *O. USTULATA* IN SOUTHERN ENGLAND BY VICE-COUNTY (SEE RECORDS)

Not recorded	Presumed extinct	Surviving at present in less than 20% of recorded sites in v.c.	Modest populations survive	Main populations
1, 2, 4, 5, 18, 27, 38.	3, 6, 16, 17, 19, 21, 23, 24, 25, 26, 28, 29, 31, 32, 34, 36, 37, 39, 40, 55, 55b.	9, 10, 13, 20, 22, 30, 33, 53.	11, 12, 15.	7, 8, 14.

TABLE 3. ABUNDANCE OF *O. USTULATA* FOR EACH VICE-COUNTY OF SOUTHERN ENGLAND

Vice-county		Colony status (see code)									Number of colonies
Number	Name	A	B	C	D	E	F	U	PX	X	
1	W. Cornwall										No record
2	E. Cornwall										No record
3	S. Devon								1	3	4
4	N. Devon										No record
5	S. Somerset										No record
6	N. Somerset									7	7
7	N. Wilts.	3	2		2	1		2	7	1	18
8	S. Wilts.	6		1		3	3	36	1	1	51
9	Dorset	2							1	9	12
10	Wight			1					1	10	12
11	S. Hants.	1	1						1	4	7
12	N. Hants.	5		2						9	16
13	W. Sussex			1						5	6
14	E. Sussex	5	5		2	1	1	9		2	25
15	E. Kent	6	1							8	15
16	W. Kent									3	3
17	Surrey								2	8	10
18	S. Essex										No record
19	N. Essex									2	2
20	Herts.	1							1	9	11
21	Middlesex									1	1
22	Berks.		1						7	9	17
23	Oxon								1	1	2
24	Bucks.									5	5
25	E. Suffolk									1	1
26	W. Suffolk									5	5
27	E. Norfolk										No record
28	W. Norfolk									1	1
29	Cambs.									12	12
30	Beds.		1							9	10
31	Hunts.									1	1
32	Northants.									4	4
33	E. Gloucs.			1					1	19	21
34	W. Gloucs.									8	8
36	Herefs.									2	2
37	Worcs.									5	5
38	Warks.										No record
39	Staffs.									2	2
40	Salop									6	6
53	S. Lincs.	1								9	10
55	Leics.									2	2
55b	Rutland									3	3
	Total	30	11	6	4	5	4	47	24	186	317

populations are generally small, and an examination of Table 3, in which current colony strengths in each vice-county are displayed, shows that S. Hants (v.c. 11) has only two small populations remaining, N. Hants (v.c. 12) has seven modest ones, and E. Kent (v.c. 15) has seven small ones. Apart from the total extinctions indicated above, other rates of decline have been dramatic – Gloucestershire (E. Gloucs., v.c. 33, and W. Gloucs., v.c. 34) had a total of at least 29 separate populations in the past, but only one colony was definitely found to survive during the course of this survey, and other vice-counties with many previously recorded populations show the same trend, e.g. Dorset, v.c. 9, (two remaining from twelve), Berks., v.c. 22, (one from 17), Wight, v.c. 10, (one from twelve), Herts., v.c. 20, (one from eleven), and Beds., v.c. 30, (one from ten). The stronghold

TABLE 4. ABUNDANCE OF *O. USTULATA* IN THOSE 10-KM SQUARES OF SOUTHERN ENGLAND IN WHICH THE SPECIES SURVIVES

10-km square	Number of colonies	Colony status (see code)
31/8.1	1	A
31/9.5	1	E
40/4.8	1	C
41/0.1	3	A,A,B
41/0.4	4	C,E,E,F
41/0.6	1	A
41/1.2	4	A,A,F,F
41/1.6	4	B,E,D,D
41/2.2	2	A,A
41/2.4	1	A
41/2.7	2	A,B
41/2.8	1	A
41/3.3	1	A
41/3.5	1	A
41/3.6	1	A
41/4.5	4	A,A,C,C
41/5.5	1	A
41/5.8	1	B
42/1.3	1	C
43/9.4	1	A
50/5.9	4	B,B,B,D
51/2.1	1	C
51/3.0	1	D
51/4.0	1	F
51/4.1	1	A
51/5.0	7	A,A,A,A,B,B,E
51/8.6	1	A
52/1.3	1	B
52/3.3	1	A
61/0.4	1	A
61/2.4	5	A,A,A,A,B
Total 31	60	

of distribution is now undoubtedly S. Wilts (v.c. 8), E. Sussex (v.c. 14), and to a lesser extent, N. Wilts (v.c. 7), all of which have some excellent thriving colonies, and on some of the extensive downland especially in S. Wilts., other relatively small colonies may yet await discovery. However, it can be seen that of the 60 extant colonies confirmed during this survey, there are now only nine which in a good year contain typically 200+ flowering plants, and only four of these exceed 1000. A breakdown of current colony size by 10-km square is given in Table 4.

Causes of decline appear to be more frequently due to agricultural improvement than to other direct physical causes, and to some extent this contrasts with the situation in northern England where other pressures such as building and industrial encroachment have taken their toll. Ploughing with or without re-seeding, and the use of artificial fertilisers or herbicides are the main causes of site loss in southern England. During World War II, much downland, which because of its gentle topography could be easily worked agriculturally, was pressed into use, and many suitable habitats for *O. ustulata* were consequently lost. Overgrazing may also have had a detrimental effect, and still occurs at many sites. This, whilst perhaps not too damaging in the short term will, if prolonged over many years, greatly reduce population numbers, although usually some plants may persist in a vegetative state.

Other than physical destruction, an examination of the records for *O. ustulata* (see also Figure 1) reveals a declining distribution towards the south and east of England, and to those geographical centres of former population density. This reinforces the theory of a deteriorating climatic situation, causing a contraction of range perhaps over the last several decades, and a similar observation has

been made for *Ophrys sphegodes* (Hutchings 1987), another orchid of calcareous grassland, which like *O. ustulata* is also near the limit of its range in southern England and is in decline. If such is the case, recently extinct but still intact sites for *O. ustulata* would be less likely to be subsequently recolonised in the less favourable conditions pertaining, and the existence of much seemingly suitable but unoccupied habitat in the survey area is typical of a species at the edge of its range – and if now under conditions of a deteriorating climate, is likely to remain so. Other, minor causes of loss of sites include scrub colonisation, quarrying, and building development.

Fortunately many of the surviving colonies are protected either as nature reserves or by having S.S.S.I. status, and here *O. ustulata* should respond to management. Other colonies not so protected usually lie on easily worked ground and at these sites agricultural upgrading will remain a threat.

During the course of this survey, some of the more obscure old records have been found difficult to trace and have not yet been fully identified; but work on these continues. Publication of this survey may generate information on these and other sites, which the author will be interested to receive, with a view to presenting a future summary.

RECORDS

Note: References in the form 00/0.0 refer to 10-km squares, whilst four-figure references placed after localities and in the form (00.00) refer either to tetrads or to 1-km squares; however these latter are not given for large populations or for sensitive localities.

S. Devon, v.c. 3: 20/5.4, Wembury (Bovisand), recorded in 1932 (PX); 20/8.3, Start Point, specimen in **DMTH**, *J.R.P. Furze*, undated (X); 20/9.5, Berry Head, Brixham, prior to 1860 (X); 20/9.6, Babbacombe Down and Torquay, pre-1860 (X). (An old 19th century record for 20/5.6, Shaugh Vale, near Plymouth is thought to be an error.) Ivimey-Cook (1984) states: "There is no evidence for the continued existence of *Orchis ustulata* L., the Burnt Orchid, in Devon".

N. Somerset, v.c. 6: 31/3.6, Worlebury Hill (32.62), last record in 1838 (X); 31/4.5, Mendip Hills, three sites, at two of which it became extinct in last century (near Churchill (44.58) in 1847; and at Wavering Down, *W. F. Miller*, (40.56) in 1892) (Roe 1981); whilst at the third site, Callow Hill, it was last seen in 1959 by J. Hodgson, shortly after which the site was quarried away (R. G. B. Roe pers. comm.), but there is a specimen in **LANC** from the Cheddar area collected by E. Hodgson in 1961 in a "limestone copse" which may be the same site as Callow Hill (X, X, X); 31/4.7, Weston-in-Gordano (44.74) last recorded in 1850 (X); 31/5.7, Leigh Down (54.72) last recorded in about 1850 (X); 31/7.6, Claverton Down, Bath, (76.62) plentiful up to the end of the 19th century and last recorded in about 1920 by N. Y. Sandwith (Roe 1981), after which it is thought to have succumbed to human pressure and changes in agricultural practice (X); known in the Bath area since c. 1760.

N. Wilts., v.c. 7: 31/8.6, South Wraxall (Grose 1957) (X); 41/0.6, Morgan's Hill, Roundway Hill, Tan Hill, Beckhampton Down, four sites all mentioned by Grose (1957), but agricultural spraying in this area may have eliminated some populations (D. Green pers. comm.) (PX,PX,PX,PX); Cherhill S.S.S.I. (04.68), 8 plants in 1978 (D. Green pers. comm.) (A); 41/1.6 Pewsey Down N.N.R., very strong group of early- and late-flowering populations which include Wansdyke (10.64) (B); Milk Hill (E); Walkers Hill (D); and the late-flowering Knap Hill colony (D); Martinsell Hill, Golden Ball Hill (Grose 1957) (PX,PX); 41/1.7, Rockley Down (Grose 1957) (U); 41/1.8, Wroughton (Grose 1957), last reported in 1888, now very doubtful (D. Green pers. comm.) (PX); 41/2.7, Peaks Downs (24.78), 11 plants in 1985 (D. Green pers. comm.) (B); Aldbourne (Grose 1957) (U); Bailey Hill (26.78), less than 10 plants in 1987 (D. Green pers. comm.) (A); 41/2.8 Russley Down, (26.80), 6 plants in 1987 (D. Green pers. comm.) (A).

S. Wilts., v.c. 8: 31/8.3, Mere (Grose 1957) (U); 31/8.5, Westbury Downs (Grose 1957) (U); 31/9.3 (or 9.4), Bishopstrow Down and Stockton Down (Stearn 1975) (U,U); Park Bottom (95.37) (Stearn 1975) (U); near Grant Ridge Wood (Grose 1957) (U); 31/9.4, Scratchbury Camp, Heytesbury, near Warminster, 3 sites given by Grose (1957) (U,U,U); 31/9.5, Great Cheverell Hill, nature reserve, south-facing slope with *Platanthera bifolia*, up to 500 plants in good years (E), some with pure white flowers (Stearn 1975); Bratton (Grose 1957) (U); 31/9.6, Heddington (Grose 1957) (U); 41/0.2, Bishopstone (Grose 1957) (U); 41/0.3, Stapleford, collected by W. M.

Rogers in 1873, **LANC** (U); Little Langford, Ebsbury Hill, Barford Down, Steeple Langford – Cow Down, 4 sites given by Grose (1957) (U,U,U,U); 41/0.4, Yarnbury Castle, Winterbourne Stoke, around ancient earthwork, heavily grazed, but potentially a strong colony (E); Parsonage Down, two very strong populations, respectively (E,F); West Down, Tilshead (06.48) M.O.D. area with heavy vehicles active, formerly robust plants with *Orchis morio* (B. G. Tattersall pers. comm.) but now 'improved' (X); Orcheston Down, 50 plants in 1988 (B. G. Tattersall pers. comm.) (C); near the Bustard, some with white flowers (Stearn 1975) (U); 41/0.5, near Wilsford (Grose 1957) (U); 41/0.6, Etchilhampton Hill (Grose 1957) (U); 41/1.2, Pennings Lane (11.24) seen in 1987 (A. Hutchison pers. comm) (U); Homington Down (12.24), two small colonies in 1987 (A. Hutchison pers. comm.) (A,A); Odstock Down, very strong population on west-facing steep slope (F); Clearbury Down, extensive population on gentle south-facing slope (F); 41/1.3, High Post (Stearn 1975) (U); Netton, Laverstock, (Grose 1957) (U,U); 41/1.4, Stonehenge, recorded by J. R. Akeroyd in 1966 when (B), *W. M. Rogers*, specimen in **LANC** (PX); near Fittleton and Nether Avon, Amesbury, Milston, Larkhill, (Grose 1957) (U,U,U,U); 41/1.5, Milton Lambourne (Grose 1957) (U); 41/2.2, Witherington Down (20.24) currently heavily grazed (A); Dean Hill (Grose 1957) (U); Pepperbox Hill (21.24), occasional in 1985 (A. Hutchinson pers. comm.) (A); 41/2.3, Winterslow (Grose 1957) (U); 41/2.5, Sidbury Hill, Ludgershall, Everleigh, Easton Hill, all given by Grose (1957) (U,U,U,U); 41/3.5, Fosbury (30.56), two plants of late-flowering variant, July 1988 (A. Hutchinson pers. comm.) (A); 41/3.6, between Ham Hill and Rivar Hill (Stearn 1975) (U); Ham Hill Reserve, about ten plants of late-flowering variant, July 1988 (A. Hutchison, S. L. Jury & J. R. Akeroyd pers. comms) (A). (Grose (1957) comments that although there are many sites scattered throughout v.cc.7–8, many have only a very few plants.This is probably even more the case today.)

Dorset, v.c. 9: 30/8.8, Lulworth, last recorded in 1895 (X); East Stoke, last record 1895 (X); 30/8.9, Milborne St Andrew in 1895 (X); 31/8.0, Stourpaine, last seen in 1904 (X); 31/8.1, Hod Hill, last recorded in 1930, but may still persist (PX); Fontmell Down (H. J. M. Bowen pers. comm.) (A); 31/9.0, Blandford, not seen since 1799 (X); 31/9.1, Gussage St Michael in 1895 (X); Farnham in 1895 (X); Ashmore in 1895 (X); 40/0.8, Old Harry Cliffs (05.82) in 1895 (X); 41/0.1, Bokerley Ditch, Martin Down (05.17), still surviving (H. J. M. Bowen pers. comm.) (A).

Wight, v.c. 10: 40/4.8, Garstons Down, discovered in 1973 at a bowl-shaped depression in the chalk, usually 20–30 plants, but over 300 in 1974 (C) (B. Shepard pers. comm.); 40/5.7, Rew Down (54.76) last recorded in 1966, now thought to be extinct due to scrub colonisation (X); 40/5.8, Ashey Down (57.87) last seen in 1966 since which time there has been a change in the grazing pattern (PX).

Recorded from some 12 chalk pasture sites on the island since about 1820, but reputedly known at very few to any one generation of botanists (B. Shepard pers. comm.).

S. Hants., v.c. 11: 40/2.9, West Lymington in 1883 (X); 41/0.1, Bokerley Ditch, Martin Down (04.18) few plants on the side of an ancient ditch (B. G. Tattersall pers. comm.) (B); also a second site nearby (A), and variant with white flowers (A. Hutchison pers. comm.); 41/3.2, near Bossington (32.28), chalk alluvial water meadow, late-flowering variant occurring with *Gymnadenia conopsea* var. *densiflora* in atypical habitat for the species, 14 spikes in 1956, last recorded in 1962, but site planted with *Populus* sp. in c. 1970 (R. P. Bowman pers. comm.) (PX); Romsey area, last known in 1883 (X); 41/4.2, Compton Down (prob. 46.24) recorded last in 1878 (X); 41/6.2, Pink's Hill, Warnford (60.22) in 1848–50 (X).

N. Hants., v.c. 12: 41/2.4, Tidworth Golf Links (20.48), small population (Lady A. B. M. Brewis pers. comm.) (A); Kimpton Downs (24.46), ploughed in 1870 (X); 41/3.3 Chattis Hill (32.36) last recorded in 1936 (X); Danebury Hill (32.36) not recorded from 1964 to 1985, and thought to have become extinct due to undergrazing following the demise of the rabbit population until rediscovered in 1986 by P. Wilson (A. J. Byfield pers. comm.) (A); 41/4.3, The Gallups, Worthy Down (44.34) ploughed in 1952 (X); Flower Down (44.30) last recorded in 1799, subsequently built upon (X); 41.45, Woodcott Down (44.56) ploughed after 1892 (X); Litchfield Down (44.54) recorded in 1892 but ploughed at a later date (X); Ladle Hill around ancient earthwork but often heavily grazed, late-flowering variant (C); near Old Burghclere, transplanted here in 1985 from a nearby threatened area, but has still not flowered (P. Brough pers. comm.) (A); Ashley Warren, late-flowering variant, recently threatened by motor-cycle scrambling and undergrazing (C); Watership Down, north of Gallups (49.56), late-flowering variant, two plants in 1988 (A); 41/5.4,

Downs near Micheldever Station (50.42) last recorded in 1873 and later ploughed (X); near Southwood Farm (58.46) in 1859 and later ploughed (X); 41/5.5, near Wolverton Farm (54.56) in 1870, ploughed (X); White Hill, east-facing slope, discovered here recently, late-flowering variant (P. Brough pers. comm.) (A).

W. Sussex, v.c. 13: 41/7.1, Harting 1889 (Arnold 1907) (X); 51/2.0, Portslade, Southwick (Arnold 1907), since built upon (X); 51/2.1, Newtimber Hill, Poynings, refound in 1983 by D. Batchelor when 33 plants, nine plants in 1984, 52 plants in 1985 (M. Briggs, D. C. Lang pers. comm.) (C); this area Newtimber/Saddlescombe/Pyecombe (Arnold 1907; Wolley-Dod 1937) could have been the same formerly more extensive colony (X); Henfield (Arnold 1887) (X). (The locality of a record for "Summersdean", E. Payne (Arnold 1887) has not been traced (X)).

E. Sussex, v.c. 14: 50/5.9, known from nine tetrads (Hall 1980), and scattered frequently in the pastures near Beachy Head (Arnold 1907), including Seven Sisters (52.98), 15 plants in 1985 (B); and same area (52.96) (Hall 1980) (U); Cuckmere Haven (50.96) (Hall 1980) (U); Kiln Combe, East Dean (Bullock Down), a north-facing, undergrazed chalk slope (B. G. Tattersall pers. comm) (D); also near East Dean (54.96) (Hall 1980) (U); near Friston (54.98) (Hall 1980) (U); Cow Gap (58.96), (Arnold 1907), ten plants in 1967 (B); downs above Meads (58.98) (Arnold 1907) (U); Whitbread Hollow (58.94) small colony (B); 51/3.0, Castle Hill, Falmer, south-facing downland with several colonies of varying size (B. G. Tattersall pers. comm.) but in total (D); Telscombe Tye (38.00) formerly (B) but destroyed c. 1970 (D. C. Lang pers. comm.) (X); 51/3.1, Standean, Patcham (30.10) formerly (A) but now destroyed (D. C. Lang pers. comm.) (X); 51/4.0, Mount Caburn, Glynde, 1000+ plants in a good year (B. G. Tattersall pers. comm.), short grazed turf on and around an ancient earth fort (F); also at (44.08) (U); near Firle Beacon (48.06) (Hall 1980) (U); 51/4.1, Cliffe Hill (43.10) (Arnold 1907) (U); Saxon Down, Glyndebourne (44.10) (A); 51/5.0, Cradle Hill, High and Over (50.00) 20 plants in 1972 (B); The Rails, Alfriston (50.02) four plants in 1965 (A); east of Alfriston (52.02) (Hall 1980) (U); Charleston Bottom (52.00) two plants in 1973 (A); Lullington Heath (54.02) (A), but 50 plants in 1981; Jevington (56.00) recorded in 1979 (A); Meachants, Willingdon, late-flowering variant, often 200+ plants (E) (B. G. Tattersall pers. comm.) and merging with a second colony of c. 15 early-flowering plants on a north-facing chalk slope (Combe Hill) (B. G. Tattersall pers. comm.) (B); 51/9.1, Rye Harbour (Hall 1980) is considered to be an error (M. Briggs pers. comm.). (Some tetrads listed by Hall (1980) in 50/5.9 are now possibly extinct, due to public pressure on the Downs.)

E. Kent, v.c. 15: 51/7.6, Bluebell Hill, prior to 1900 (X), some with white flowers (Hanbury & Marshall 1899); 51/8.6, Queen Down Warren, south-facing chalk downland, very small colony with *Ophrys sphegodes*, *Aceras anthropophorum*, and *Orchis morio* (B. G. Tattersall pers. comm.) (A); 61/0.4, Wye Downs (06.44) (A); 61/0.6, Badgen Downs, near Faversham (Hanbury & Marshall 1899) (X); 61/1.3 (or 2.3), west of Folkstone, downland c. 1890 (X); 61/1.5, near Canterbury (Hanbury & Marshall 1899) (X); 61/2.4 Warren Bottom, two small colonies (24.44) with *Ophrys sphegodes* and *Orchis morio* (B. G. Tattersall pers. comm.) (A, B); Lydden, three small colonies (26.44) (B. G. Tattersall pers. comm.) (A,A,A); 61/2.5, near Wingham (Hanbury & Marshall 1899) (X); 61/3.4, St Margaret's at Cliffe in 1901 (X); Langdon Bay (34.42) recorded in 1954 and surviving for perhaps a further ten years (E. G. Philp pers. comm.) (X); downs near Dover, one specimen with white flowers (Hanbury & Marshall 1899) (X).

W. Kent, v.c. 16: 51/5.5, between Knockholt and Wrotham, several colonies, last recorded in 1845 (X); 51/5.7, Dartford, recorded in 1821 (X) (E. G. Philp pers. comm.); 51/6.7, Gravesend (Hanbury & Marshall 1899) (X).

Surrey, v.c. 17: 41/9.4, Hog's Back, Guildford, last recorded in 1874 (X); 51/1.4, White Downs, reported in 1976 but not substantiated (Lousley 1976), also very old record for this or the adjacent 10-km square (specimen in **BON** collected by A. Halley) for Dorking area in 1841 (PX); 51/2.5, Buckland Hills (22.52), small colony in 1946 (X); Walton Downs (22.57) known here since 1927, one plant seen in 1966 and now thought to be lost due to scrub colonization (X); Gatton Park (26.52), last recorded in 1965 (X); Betchworth recorded in 1884 (X); Wingate Hill in 1965 (Lousley 1976) (PX); Juniper Hill, Reigate Hill and Headley Hill, three 19th century sites (Salmon 1863) (X,X,X).

N. Essex, v.c. 19: 52/4.4, near Strethall, possibly on the strip lynchets of Coploe Hill in about 1860, lost probably due to arable cultivation (Gibson 1862; Jermyn 1974; K. J. Adams pers. comm.) (X); 52/8.3 (or 8.4), Sudbury. Recorded here by G. S. Gibson in the last century (Gibson 1862),

but some doubt as to whether the site might be actually in Suffolk. Lost probably due to arable development (K. J. Adams pers. comm.) (X).

Herts., v.c. 20: 42/9.1, Tring (92.10) recorded in 1815, probably lost due to changing agricultural practices (X); near Tring Station (94.12) in 1883, changes in agriculture and scrub colonisation causing loss) (X); Aldbury (96.12) in 1887 lost due to scrub colonisation (X); 52/0.1, near Isle of Wight Farm, Kensworth (00.18) in 1887, lost to agriculture (X); 52/0.2, Ravensthorpe Castle (08.28) last record 1924, subsequently afforested (X); 52/1.3, High Down (13.30) in 1843 lost to agricultural changes (X); Bury Mead (18.30) recorded in 1843, site now built upon (X); 52/2.3, Arbury Banks (26.38) in small numbers up to the late 19th century, when agricultural methods changed (X); 52/3.3, Therfield Heath, two sites (32.38) – last record here was of a single plant in 1979 (B. Sawford pers. comm.) (A,PX), and also 52/3.4, scattered sparingly in the 1880s but lost with the cessation of grazing (34.40) (X).

Middlesex, v.c. 21: 51/0.9, Harefield, pre-1737 record from a chalk pit – J. Blackstone 1737 (X).

Berks., v.c. 22: 41/2.8, Kingstone Down and Whitehorse Hill, formerly two sites but no records traced since 1890 and 1964 respectively (X,PX), (but see Steel & Creed (1982) for records for this 10-km square 1970–82) and may survive in small numbers at the latter; 41/3.8, Lambourn Downs in 1838 (X); Wantage, last record in 1859 (X); 41/3.9, Cherbury Camp in 1867 (X); 41/4.8, Gore Hill, last record 1966 (PX); East Hendred in 1961 (PX); Farnborough Downs (Bowen 1968) (PX), (but see Steel & Creed (1982) for records for this 10-km square 1970–82), may still survive in small numbers; 41/5.8, Aston Upthorpe Downs, a nature reserve especially managed for the species (H. J. M. Bowen, B. G. Tattersall, pers. comms.) (B); Blewburton Hill last record 1964 (PX); Streatley in 1950 (PX); Ilsley in 1920 (X); Churn in 1930 (X); Moulsford Downs (Bowen 1968) (PX); 41/6.7, Basildon last recorded in 1879 (X); 42/4.0, Chilswell Hill pre-1820 (X); Botley pre-1820 (X).

Oxon., v.c. 23: 42/3.0, Bampton, alluvial meadow in 1930, recorded by P. G. Beak (X); 42/4.1, Yarnton, occasional plant recorded here in the 1970s, possibly still surviving in very small numbers but no recent confirmation (H. J. Killick pers. comm.) (PX).

Bucks., v.c. 24: 41/7.8, Hambleden (78.86) prior to 1926 (Druce 1926) (X); 42/6.0, near Albury in 1935, recorded by J. Chapple (X); 42/8.0, Coombe Hill (88.08), last recorded in 1961 (X); 42/9.1, Pitstone Hill (94.14) in 1936 (X); Ivinghoe (96.16) prior to 1926 (Druce 1926) (X). The plant has not been recorded during field work for *The flora of Buckinghamshire*.

E. Suffolk, v.c. 25: 62/3.8, Bungay, specimen in **BON** pre-1903 (X) – this however could be for E. Norfolk (v.c. 27) in 62/3.9, possibly from Bath Hills. The Shelland and Hadleigh records (see below) given under v.c. 26, may in fact be from E. Suffolk.

W. Suffolk, v.c. 26: 52/7.5 (or 7.6), Dalham, last recorded pre-1889, by F. Tearle (Hind 1889) (X); 52/7.6 (or 7.7), Cavenham in 1773, by Sir J. Cullum (Hind 1889) (X); 52/7.6 (or 8.6), Risby Heath, chalk bank in c. 1860 (Hind 1889), also recorded here in 1939 by J. E. Lousley & E. C. Wallace (X); 52/9.5 (or 9.6) or 62/0.5 (or 0.6), Shelland, record in *East Anglia Daily Times*, F. Woolnough, 1921 (X); 62/0.4, near Hadleigh in 1961, Sir C. Morris (X). (Also 52/6.6, Newmarket Heath in c. 1828 (Hind 1889), but this site may be same as that for Cambs., v.c. 29 (X)).

W. Norfolk, v.c. 28: 53/6.0 (or 6.1), Shouldham, old 18th century record by R. Formby (X). No other records (C. P. Petch pers. comm.).

Cambs., v.c. 29: 52/4.4, Ickleton before 1860 (X); 52/4.5, Cherry Hinton chalk pit (48.55) last recorded c. 1880 (X); Gog Magog Hills in 1863 (X); between Stapleford and Babraham, last record pre-1860 (X); 52/5.4 near Hildersham before 1860 (X); Linton in 1832 (X); 52/5.5, Balsham Heath pre-1870 (X); Fleam Dyke (53.55) last recorded in 1941 (X); 52/5.6, Devil's Ditch in 1907 (X); 52/6.6, Devil's Ditch (62.60) in 1955 (X); Newmarket Heath pre-1889 (X); Chippenham before 1820 (X). Main causes of extinction in v.c. 29 are thought to be a combination of ploughing after enclosure of grass heaths in the 19th century, and lack of grazing of the remaining chalk grasslands.

Beds., v.c. 30: 52/0.2, Ravensburgh Castle (08.28) last recorded in c. 1930 at which time a large heap of manure was deposited on the colony from which it never recovered – site now ploughed (X); Streatley, Sundon, Sharpenhoe, Luton Downs, Warden Hills, Galley Hill (Dony 1953) (X,X,X,X,X,X); 52/0.3, Barton in the Clay, two colonies, one of which at (08.30), was last known c. 1935 subsequently lost to scrub colonisation (X,X); 52/1.3, Knocking Hoe N.N.R., small

colony of usually 6/20 plants (T.C.E. Wells pers. comm.) (B). Apparently the decline began in c. 1930 when sheep grazing of the downland ceased.

Hunts., v.c. 31: 52/0.9, Stibbington (06.98 or 08.98) record based upon a specimen collected in 1890 by Cpt. Vipan and sent to the Marchioness of Huntly who recorded this in her journal (T. C. E. Wells pers. comm.) (X).

Northants., v.c. 32: 52/0.8, Biggin (00.88) on chalk drift pre-1930 and thought to have been subsequently ploughed (X); 53/0.0, Barnack (07.04) last recorded c. 1900 by Rev. H. Slater (X); Sutton Heath (08.00) in 1926 by Miss Powell (X); Southorpe (08.02) on rough grass near railway bridge in 1956 by H. F. Tebbs (X) (Biological Records Centre record), also Rigard (1957).

E. Gloucs., v.c. 33: 31/9.9, Jackaments Bottom (95.97) small numbers recorded until the 1950s, subsequently lost to agricultural 'improvement' (X); 32/9.0, Edgworth, Miserden, Duntisbourne, Cirencester Park area (Riddelsdell *et al.* 1948) (X,X,X,X); 32/9.1, Brimpsfield to Elkstone (Riddelsdell *et al.* 1948) (X); Leckhampton Hill in 1862, specimen in **CHELB** (X); Crickley Hill, scarce in 1914 (Riddelsdell *et al.* 1948) (X); 32/9.2, Cleeve Common, (X); Prestbury (X) (both Riddelsdell *et al.* 1948); 42/0.0, Barnsley Downs (Riddelsdell *et al.* 1948) (X); Ablington Downs (09.08) last record c. 1948 when it was abundant. Site 'improved' agriculturally with small remnants which may still hold a few plants (PX); 42/0.2, Sevenhampton (Riddelsdell *et al.* 1948) (X); 42/0.3 Snowshill (Riddelsdell *et al.* 1948) (X); 42/1.0, Macaroni Downs (18.07) scattered on both sides of a dry valley, c. 30 plants in 1977, but recently 'improved' (X); Fairford (Riddlesdell *et al.* 1948) (X); 42/1.1, Northleach (Riddelsdell *et al.* 1948) (X); 42/1.2 Kineton Thorns (11.26) ploughed in 1956 (X); Notgrove and Bourton area (Riddelsdell *et al.* 1948) (X); 42/1.3, Hornsleasow Rough S.S.S.I. scattered widely over the site, which is on oolitic limestone at the remains of old quarry workings with *Orchis mascula* and *O. morio*, 300+ plants in 1965 but now much less (S. C. Holland, B. G. Tattersall pers. comms.), 25+ plants in 1988 (C); Bourton Downs (14.31) ploughed and reseeded c. 1948 (X).

W. Gloucs., v.c. 34: 31/5.7, Durdham Down (Riddelsdell *et al.* 1948) (X); 31/7.7, Wyck Cliffs (Wick Rocks) (Riddelsdell *et al.* 1948) (X); 31/9.9, Poole Keynes, Rodmarton and Culkerton pastures, very abundant in 1924 (Riddelsdell *et al.* 1948) (X,X,X): 32/5.1, Symonds Yat, **herb E.C. Townsend** (X); 32/6.0, near Lydney in 1773 (Riddelsdell *et al.* 1948) (X). 32/8.0, Minchinhampton (Riddelsdell *et al.* 1948) (X).

Herefs., v.c. 36: 32/5.1, between Rocklands and Coldwell at the foot of Coppett Hill (56.16) in 1849 (X); 32/7.4, Colwall, meadow, prior to 1889 (X).

Worcs., v.c. 37: 32/7.4, Mathon (74.44 or 74.46) recorded here in the 19th Century (Amphlett & Rea 1909) (X); West Malvern (76.46) (Amphlett & Rea 1909), site lost early this century to building (X); 32/7.6, Abberley Hill (74.64 or 74.66) in the 19th century (Amphlett & Rea 1909) (X); near Witley (Amphlett & Rea 1909), lost in the 19th century (X); 32/9.3 (or 9.4), Bredon Hill, unconfirmed report in the 1920s (X) (J. J. Day pers. comm).

Staffs., v.c. 39: 32/8.8, Kingswinford, about 1820 (Edees 1972) (X); 43/0.4, Weaver Hills, post-1900 (Edees 1972) (also old specimen in **BON**, pre-1903) (X).

Salop, v.c. 40: 32/4.7, Downton Gorge (X); 32/5.7, The Lodge, Ludlow (X); 32/5.8, Upper Millichope (X); 32/5.9, Rowley, site drained in 1904 (X); 32/7.8, The Woodland, Bridgnorth (X); 33/5.0, Harley last recorded in the 19th century (X). No records this century (Sinker *et al.*, 1985).

S. Lincs., v.c. 53: 43/9.2, Easton (X); 43/9.4, Court Leys in 1893 (X); Wilsford (X); Brandon (X); Ancaster Valley, newly discovered site in 1986 (A); 43/9.5, Navenby (X); Wellingore (X); 53/0.1, Bowthorpe in 1836 (X); 53/0.3, Sapperton in 1901 (X); 53/0.5, Temple Bruer (X).

Leics., v.c. 55: 43/5.0, near Glenfield, not recorded since c. 1795 and subsequently urbanized (X); 43/5.2, Loughborough/Zouch Mill area recorded in c. 1831 (X) (A. L. Primavesi pers. comm.). Some doubt surrounds the above records since they are not on known calcareous soils.

Rutland, v.c. 55b: 43/9.0, Shacklewell Hollow in c. 1875 (X); Ketton Heath, old record, area subsequently quarried for limestone (X); 43/9.1, Exton Park, possibly 1900–15, but later became an opencast mine site (X) (K. G. Messenger pers. comm.).

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REFERENCES

Amphlett, J. & Rea, C. (1909). *The botany of Worcestershire*. Birmingham.
Arnold, F. H. (1887). *Flora of Sussex*. London.
Arnold, F. H. (1907). *Flora of Sussex*, 2nd ed. London.
Bowen, H. J. M. (1968). *The flora of Berkshire*. Oxford.
Dony, J. G. (1953). *Flora of Bedfordshire*. Luton.
Druce, G. C. (1926). *The flora of Buckinghamshire*. Arbroath.
Edees, E. S. (1972). *Flora of Staffordshire*, Newton Abbot.
Ekstam, U., Jacobson, R., Mattson, M. & Porsne, T. (1984). *Ölands och Gotlands växtvärld*. Stockholm.
Foley, M. J. Y. (1987). The current distribution and abundance of *Orchis ustulata* L. in northern England. Watsonia **16**: 409–415.
Gibson, G. S. (1862). *Flora of Essex*. London.
Grose, D. (1957). *The flora of Wiltshire*. Devizes.
Hall, P. C. (1980). *Sussex plant atlas*. Brighton.
Hanbury, J. H. & Marshall, E. S. (1899). *Flora of Kent*. London.
Hind, W. M. (1889). *The flora of Suffolk*. London.
Hutchings, M. J. (1987). The population biology of the Early Spider Orchid, *Ophrys sphegodes* Mill. 1. A demographic study for 1975 to 1984. *J. Ecol.* **75**: 711–727.
Ivimey-Cook, R. B. (1984). *Atlas of the Devon flora*. Exeter.
Jermyn, S. T. (1974). *Flora of Essex*. Colchester.
Lousley, J. E. (1976). *Flora of Surrey*. Newton Abbot.
Meusel, F., Jäger, E. & Weinert, U. (1965). *Vergleichende Chorologie der zentraleuropäischen Flora* **1**. Jena.
Riddelsdell, H. J., Hedley, G. W. & Price, W. R. (1948). *Flora of Gloucestershire*. Cheltenham.
Rigard, F. (1957). *J. Northants. nat. Hist. Soc.* **1957**: 33.
Roe, R. G. B. (1981). *The flora of Somerset*. Taunton.
Salmon, J. D. (1863). *Flora of Surrey*. London.
Sinker, C. A., Packham, J. R., Trueman, I. C., Oswald, P. H., Perring, F. H. & Prestwood, W. V. (1985). *Ecological Flora of the Shropshire region*. Shrewsbury.
Stearn, L. F. (1975). *Supplement to the Flora of Wiltshire*. Devizes.
Steel, D. T. & Creed, P. C. (1982). *Wild orchids of Berkshire, Buckinghamshire, & Oxfordshire*. Oxford.
Wolley-Dod, A. H. (1937). *The flora of Sussex*. Bristol.

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Introgressive hybridization between *Crataegus monogyna* Jacq. and *C. laevigata* (Poiret) DC. in the Upper Thames Valley, England

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ABSTRACT

Where their ranges overlap in Britain, *Crataegus laevigata* (Poiret) DC. and *C. monogyna* Jacq. hybridize freely. The extent and causes of introgressive hybridization were investigated in the Upper Thames Valley by population sampling. Hybrid indices were calculated on the basis of leaf characters. A total of 1325 leaves from 265 trees in 17 populations was examined. The composition of *Crataegus* populations was strongly influenced by habitat, geology and management history. Evidence that coppicing reduced fecundity in the long-term was considered and this tended to encourage the introgression of *monogyna* genes into *laevigata* populations. With a reduction in the frequency of coppicing over the last 60 years, a gradual return to original taxon frequencies has occurred in a number of populations. It was suggested that differential insect grazing may have been responsible for the leaf character differences observed in the parental species.

INTRODUCTION

Two species of *Crataegus* occur wild in Britain. These are *Crataegus laevigata* (Poiret) DC. (the Midland Hawthorn) and *C. monogyna* Jacq. (the Common Hawthorn or May). These are generally accepted as good species and show a range of reliable, correlated characters (Franco 1968; Byatt 1975). Both species are shrubs or small trees growing to about 8 m, and commonly surviving to more than 100 years. Both are found widely in Europe where they are differentiated into a number of distinct geographical races. Those occurring in Britain are *C. laevigata* subsp. *laevigata* and *C. monogyna* subsp. *nordica* Franco. *C. monogyna* is a highly variable species in Europe and Browicz (1972) has suggested that interspecific hybridization has been partly responsible for this. Both species are diploid with 2n=2x=34.

In Britain, *C. laevigata* is the rarer plant, occurring in 43/112 (or 38%) of vice-counties (Clapham *et al.*, 1962) whilst *C. monogyna* is found in all British vice-counties. Under natural conditions, the two species are ecologically isolated. *C. laevigata* is typically a woodland plant with a strong preference for clay and loam soils. This more or less restricts it to the clay soils of the English midlands and Kentish Weald where it is surrounded by limestones such as chalk, oolite and carboniferous limestone. In contrast, *C. monogyna* prefers open habitats and is a dominant scrub species. It is rare only on very acid soils such as peat.

Where their ranges overlap, these species regularly show introgressive hybridization resulting in a range of variants between the morphological extremes of the parental species. This 'hybrid swarm' results from successive crossing and back-crossing over several generations (Anderson 1949). Hybrids, i.e. plants which are intermediate in gross morphology between the parental morphs (Bradshaw 1971; Byatt 1975; Williams 1989), are also intermediate in leaf surface microanatomy, and in the occurrence of flavonoids (Gosler 1981). Byatt (1975) showed that *C. laevigata* occurred widely in the Kentish Weald but suggested that it had only crossed the chalk by introgression with *C. monogyna*. She suggested that introgression had been so widespread in that region that pure stands of *C. monogyna* could be found only on the chalk scarp slopes and that none of *C. laevigata* existed. Williams (1989) has found that hybridization between the two species has also been extensive in remnant hedges in the London Borough of Brent.

Anderson (1949) described a detailed genetic model of introgressive hybridization between two species. This identified three essential components. Firstly, the characters which allowed the recognition of introgression were controlled by polygenic complexes with a high degree of correspondence between the respective specific genomes. Secondly, there should be some 'hybridization' of the habitat which allowed a morphological transition to occur between the two species across an environmental gradient. The third factor was that which caused the initial contact between the two species. This was usually some environmental disturbance which might be natural (as described in *Iris* by Anderson) or might be due to human activity. Bradshaw (1953) showed that man's influence was the most important factor causing syntopy in the British Crataegi.

Anderson and his students worked mainly with annual and perennial herbs. These are relatively short-lived plants with a rapid life-cycle, but are frequently self-pollinated. Natural selection may act very rapidly in such a population so that significant changes in gene frequencies may be observed after only a few flowering seasons. In a small tree such as *Crataegus* which does not flower until it is 15 years old (or until 15 years have passed since coppicing) and may live 100 years, selection may act most strongly at a particular time in the life-cycle. The habitat may have little effect on an individual's survival but may significantly reduce its flower production or fruit-set. Hence the habitat may induce a differential specific fecundity which determines the morphological direction to which the population will move in subsequent generations.

Bradshaw (1971) showed that the British Crataegi were outbreeders showing between 30% and 59% fruit-set when cross-pollinated artificially, but only 2% fruit-set when selfed. Similarly, fruit-set was almost as high in interspecific crosses as in intraspecific ones. An examination of stained pollen showed no significant reduction of pollen stainability in hybrid plants, remaining above 95%. This established that full introgressive hybridization was genetically possible, and the need to outbreed greatly increased the probability of hybridization. Since *Crataegus* flowers are insect-pollinated (largely Hymenoptera and Diptera), vicinism (Grant 1971) plays an important part in producing the spatial distribution of variation observed in a population. Vicinism, longevity and differential fecundity may cause a departure from panmixis which may reduce the need for a smooth environmental gradient. Thus in *Crataegus*, the transition from open scrub habitats to closed woodland may involve too sudden a change in soil moisture, nutrients or available light to show a clinal change in morphology across the ecotone.

This paper considers the nature, extent and causes of introgressive hybridization between *C. laevigata* and *C. monogyna* in the Upper Thames Valley by the detailed analysis of selected populations. Agriculture is the principal land use in the region and fields have traditionally been bounded by hedges. In the north, fields tend to be smaller, and here, hedges may be associated with boundary ditches and/or banks indicating the great age of the boundary (Rackham 1987). The area is geologically diverse and of comparable age to the wealden beds of Kent and Sussex – so providing an interesting comparison with Byatt's (1975) survey of that region. Fig. 1 shows the drift geology and stratigraphy of the present study area (spanning some 135 million years). The soils reflect this geological series but are influenced also by the deposition of alluvium by the Thames and its tributaries. Little has been published on *Crataegus* hybridization in this area although the range of geology, and especially the close proximity of clays and limestones provides a unique opportunity for such a study.

MATERIALS AND METHODS

For present purposes, the Upper Thames Valley study area has been defined as that lying between northings 41/70 and 42/30 and between eastings 30 and 70 of the Ordnance Survey National Grid. This area covers some 2400 km^2 and includes all of the Thames between Reading and Oxford. The work was carried out during June 1981 by which time the foliage was mature, most flowering had ceased and fruits were forming. Seventeen populations were selected for sampling, and some attempt was made to include *C. laevigata* populations cited by Bowen (1968). Site details are given in Table 1, and their locations are shown in Fig. 1. In most cases, specimens were collected along transects oriented to run across any apparent woodland/scrub gradient. When sampling hedges, specimens were taken at 5 m intervals.

Two-year old twigs of up to 50 cm in length were cut from each of 15 (but see Table 1) trees in each

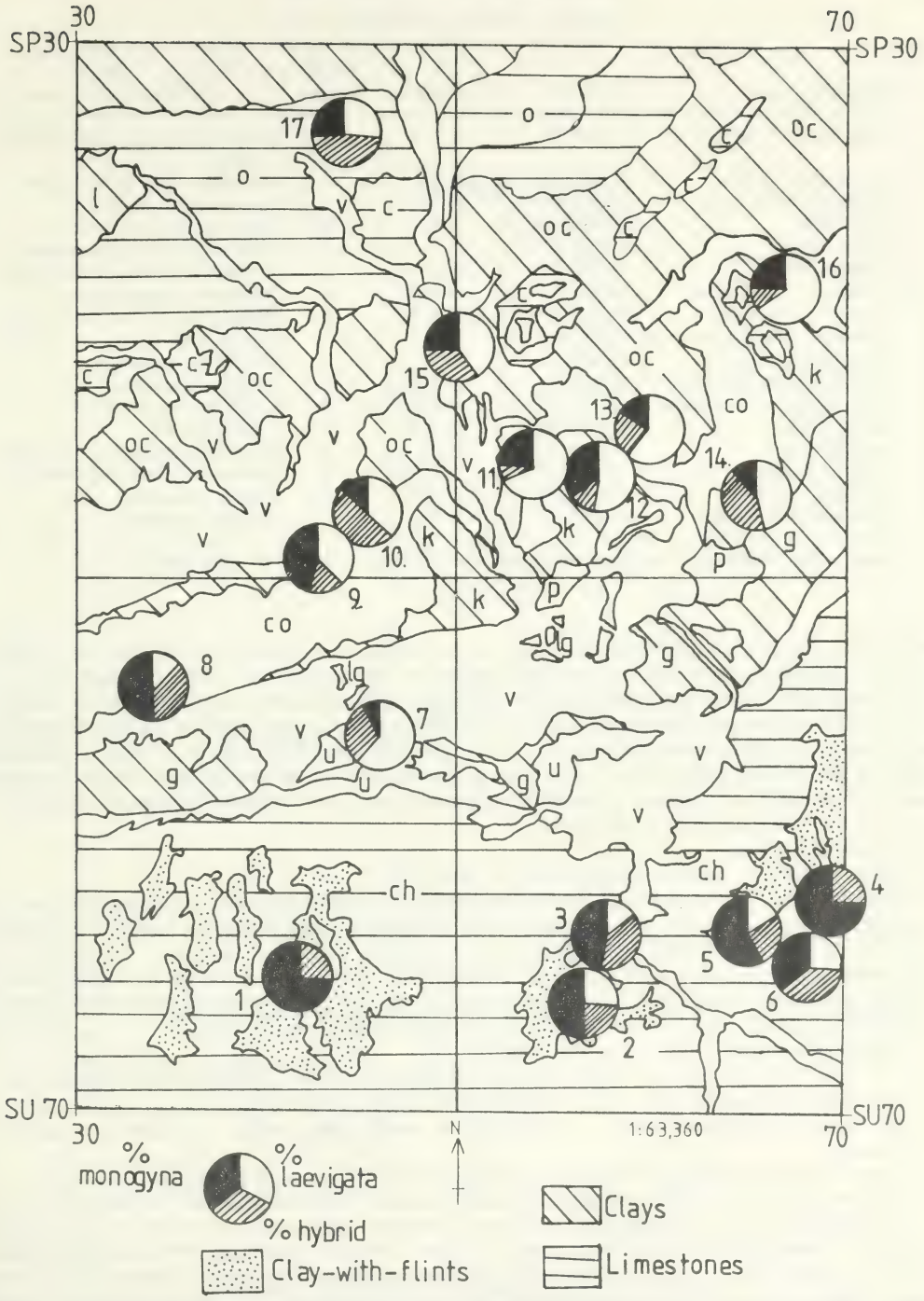

FIGURE 1. Map of the Thames Valley study area, showing the drift geology (based on Holmes & Wilson 1960) and the location of the sampled *Crataegus* populations (numbered 1 to 17 as in Table 1). The pie diagrams indicate the proportion of each taxon in the population. The geological strata are labelled as follows: V alluvium, Ch Chalk, U Upper Greensand, G Gault, Lg Lower Greensand, P Portland beds, K Kimmeridge, Co Corallian, Oc Oxford clays, C Cornbrash, O Great Oolite, L Lias.

TABLE 1. POPULATION DETAILS

	Population name	Grid ref.	n[a]	Habitats[a]	No. of Shrubs	Description and notes
1	Brightwalton Common	41/422.806	15	H E W	7	Hedge along edge of Sycamore wood.
2	Ashampstead Green	41/561.773	15	H W	10	Old hedge along Beech wood.
3	Streatley Gold course	41/583.806	15	H	5	Open boundary hedge.
4	Cock's Hill	41/662.818	10	H E	10	Old hedge by Beech wood.
5	Exlade Street	41/661.815	15	H	9	Old hedge by Pine plantation.
6	Highland Wood	41/690.788	15	H W	9	Roadside hedge by Beech wood.
7	Steventon Village Wood	41/469.912	15	H W E	8	Deciduous coppiced wood.
8	Stanford-in-the-Vale	41/325.953	15	H W E	8	Hedge by wet wood on Corallian.
9	Appleton Lower Common	42/425.005	15	W H E	7	Ancient Oak wood.
10	Eaton Heath Wood	42/442.035	15	W H	5	Disturbed Oak wood.
11	Open Magdalen Wood-west	42/554.057	15	W H E S	9	Scrub and Oak wood.
12	Open Magdalen Wood-east	42/557.058	14	W H E S	9	Scrub and Oak wood.
13	Holton Wood	42/593.075	15	W H E	8	Coppiced wood.
14	Fernhill Wood	42/658.042	15	H E	4	Hedge running through wet wood.
15	Stratfield Brake	42/499.119	30	W H E S	8	Scrub and ancient Oak wood.
16	Rushbeds Wood	42/665.158	15	W H E	11	Ancient Oak wood.
17	Glympton Park Estate	42/433.238	15	H W	10	Sycamore coppice.

[a] n = sample size; Habitats: H hedge, E woodland edge, W wood, S scrub. See also Table 2.

population. These were taken from the southern side of the tree and were selected on the presence of short vegetative shoots required for leaf examination. No attempt was made to collect flowers or fruit consistently as these were often too high to sample, although a measure of total flower and fruit production was recorded (see points 4 and 5 below). Hence the present analyses are based largely on vegetative (and especially leaf) characters. Specimens were taken from below 2·5 m high. Although sampling was random with respect to the types of plants collected the sample sizes dictate that some caution should still be exercised in the interpretation of results of 'between-population' analyses. In the field, the following data were collected:

1. Transect location.
2. A preliminary determination of identity (L, H or M).
3. Girth of the bole at 30 cm height in uncoppiced trees, or at ground level if coppiced. This gave an indirect indication of tree age. Ages were later grouped into year classes as 1) < 15, 2) 16–30, 3) 31–50, 4) 51–75, 5) 76–100, 6) >100.
4. Flowering was scored on a six point scale so that a non-flowering tree scored '0', whilst a heavily flowering plant scored '5'. Although subjective, it was felt that reasonable relative estimates of flower production could be made which were comparable between trees.
5. Fruiting was scored in the same way as flowering.
6. Tree habit was scored as (1) Coppiced bole, (2) Pollarded bole, (3) Natural (unmanaged bole).
7. Style and/or pyrene number were recorded in all fruiting specimens.
8. The habitat of each specimen was recorded as scrub, edge, hedge, woodland or woodland clearing.
9. A shrub count was made in hedges which formed part of the sampled population.

The specimens were packed in presses and dried. In total, 265 specimens were collected.

In the laboratory, five undamaged leaves were selected from short vegetative shoots on each specimen. Where possible the oldest leaves were taken. A total of 1320 leaves was measured. Where fruit was present, the presence of hairs on the hypanthium was recorded. Where stipules were present they were recorded as 'monogyna-like' or 'laevigata-like'. The presence of variegated chlorosis indicative of iron deficiency was recorded. The amount of insect damage on the whole specimen was scored on a six-point scale (0–5, where 0 = all leaves complete, 5 = all leaves show some grazing damage). All other characters were scored on the five selected leaves. A hybrid index (I) was calculated for each specimen using the method described by Anderson (1949) where a

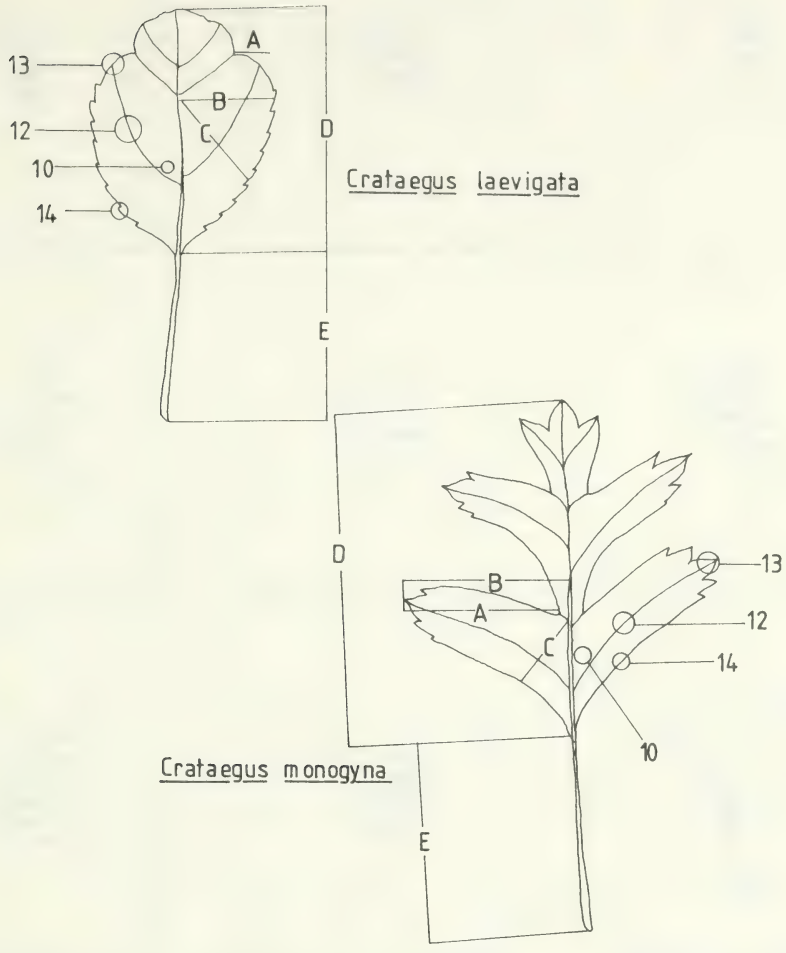

FIGURE 2. Diagram showing the leaf characters (A–E, and 10–14) used in the calculation of the hybrid index. The range of variation between the two species is indicated by the two leaves.

laevigata character state was scored as 0.0, and *monogyna* as 1·0. The full character list is as follows (see also Fig. 2):

1. Fruit hypanthium villous or glabrous
2. Depth of lowest leaf lobe sinus (mm) (A in Fig. 2)
3. Lowest lobe length (mm) (B in Fig. 2)
4. Lowest lobe width (mm) (C in Fig. 2)
5. Length of leaf lamina (mm) (D in Fig. 2)
6. Length of petiole (mm) (E in Fig. 2)
7. Ratio A/B
8. Ratio C/B
9. Ratio E/D
10. Hairs present in the vein axils of the abaxial lamina (I = 1·0)
    Hairs absent from the vein axils of the abaxial lamina (I = 0·0)
11. Number of leaf lobes (subtended by a primary vein)
12. Leaf veins curve upwards (I = 0.0)
    Leaf veins curve downwards (I = 1·0)

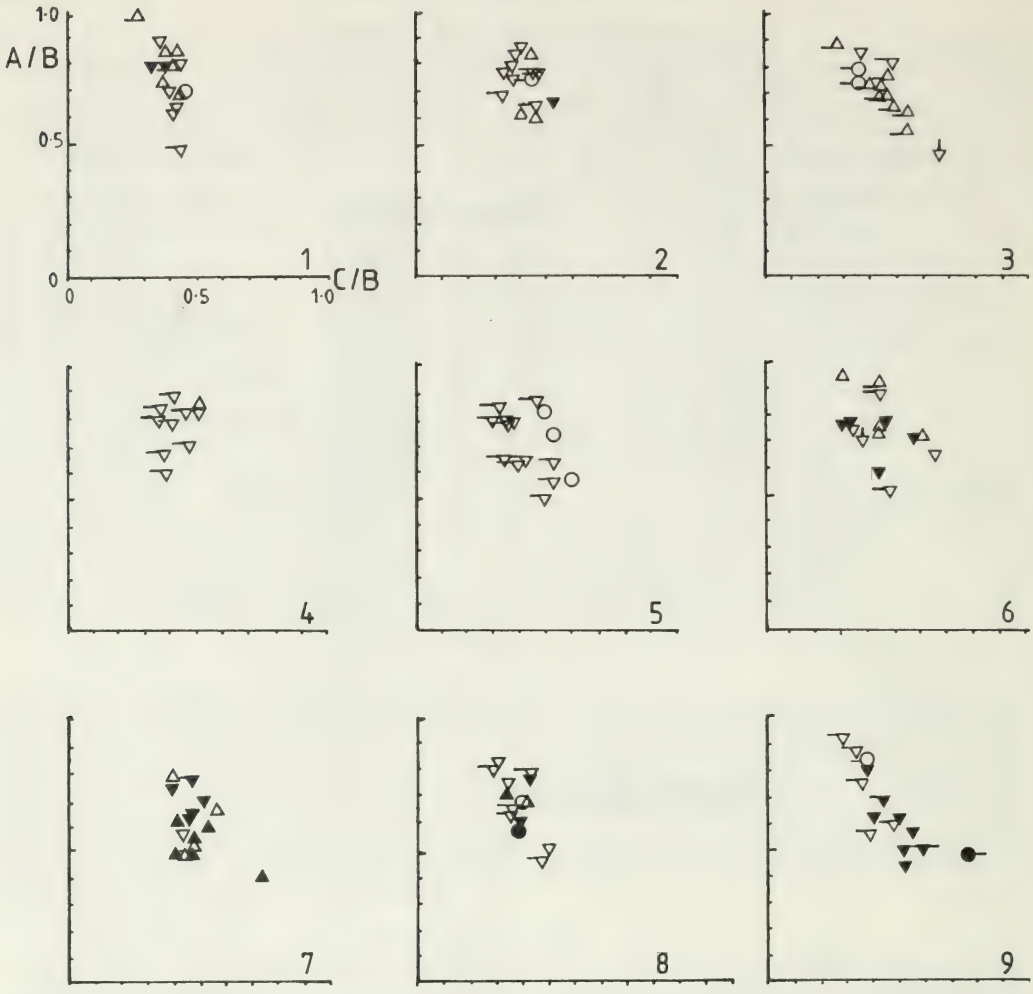

FIGURE 3. Scatter diagrams of the 17 populations showing ratio A/B plotted against C/B. See population 1 for details of axes. The following information is given for each tree: HABIT ▲ coppiced, ● pollarded, ▼ natural. FLOWER/FRUIT ● none, –● flower with 1 style, ● 1 and 2 styles, ●– 2 and 3 styles, ● flowers/fruit inaccessible. In plots 1–17, solid symbols denote a closed woodland habitat, open symbols an open habitat. The final diagram indicates the population means and their geology as □ Chalk and limestone, ▲ Upper Greensand, and ■ Clay communities. Means ± 1 S.E. are shown. Note that the axes are not as in the other diagrams.

13. Leaf lobe apex: rounded (I = 0·0)
: subobtuse (I = 0·5)
: acute (I = 1·0)
14. Leaf margin: serrate (I = 0·0)
: entire (I = 1·0)
15. Stipules if present *laevigata*-like
Stipules if present *monogyna*-like

The hybrid index was calculated as the mean scores of characters 7, 10, 12, 13 and 14. These characters were chosen because, from previous studies, they were considered to be good diagnostic characters for the two species, and/or they could be assessed for every specimen, and because the index was to be used in another study (not reported here) to assess the value of the other characters

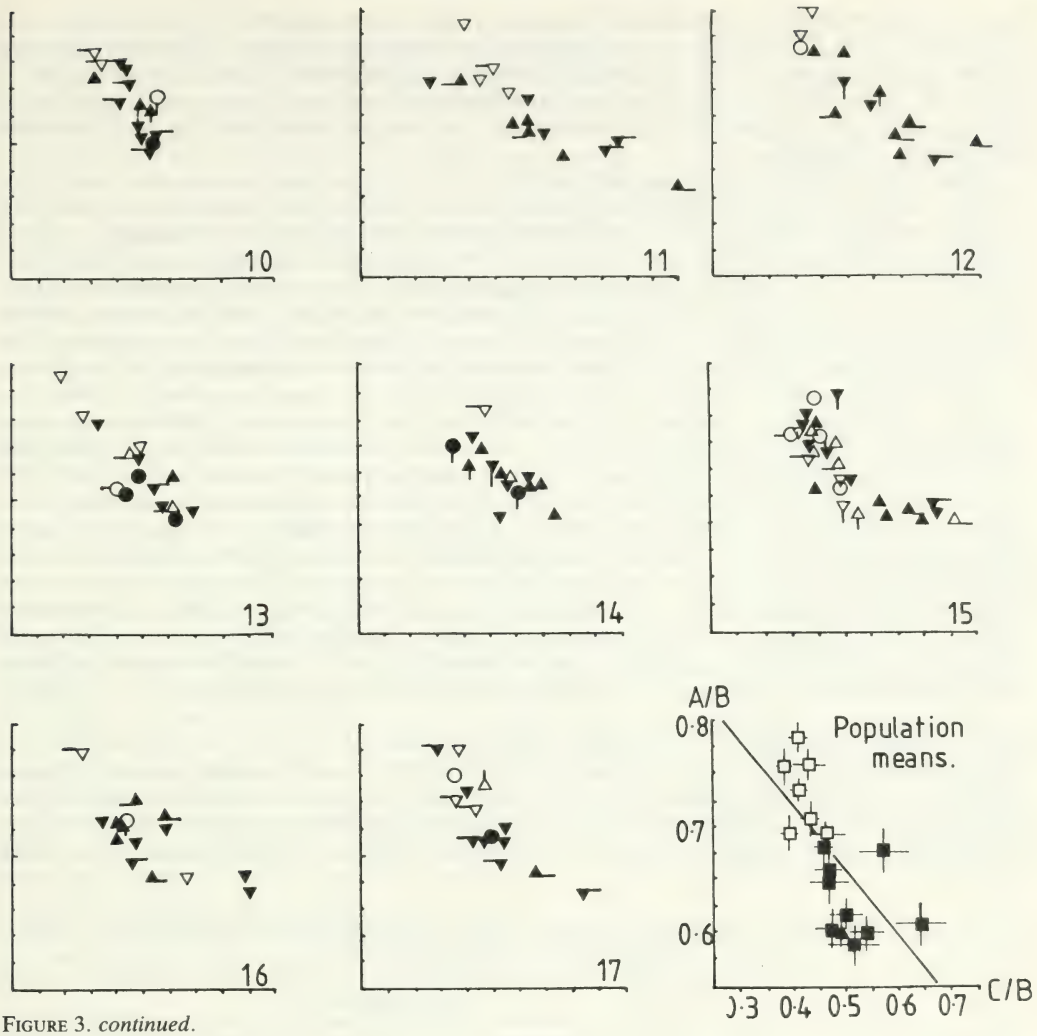

FIGURE 3. *continued*.

in specific diagnosis. In the analyses that follow *C. laevigata* is defined by a hybrid index (I) of <0·60, hybrids by I = 0·61–0·79 and *C. monogyna* by I >0·80. Statistical methods follow Sokal & Rohlf (1981) and terminology follows Stearn (1973).

RESULTS AND DISCUSSION

THE EXTENT OF HYBRIDIZATION IN THAMES VALLEY POPULATIONS

Fig. 3 shows scatter diagrams for leaf width and indentation for each population as described by Anderson (1949). The same characters (7 and 8) have been used as were used by Byatt (1975) for comparative purposes. Each point on the diagram shows the position of an individual plant relative to the axes together with its habit, habitat and style number (believed to be one of the most reliable characters). A population with a mean scatter in the upper left-hand corner of the diagram consists largely of *C. monogyna* whilst the lower right-hand corner represents *C. laevigata*. The plots have been presented in approximate geographical order from south to north. From these it is seen that chalk and limestone populations are strongly biased in favour of *C. monogyna* with considerably less

variation than populations containing *C. laevigata*. This is borne out by the hybrid index values presented in Table 2. Limestone populations showed a mean hybrid index of 0·76±0·06 whilst that for clay populations was 0·57±0·07. This difference was highly signficant (t_{15}=6·03, p<0·001). As in the Weald, there were no pure *C. laevigata* populations although pure *C. monogyna* populations were frequent. *C. laevigata* populations showed a strong preference for clay soils but were considerably hybridized.

These diagrams also show a clear habitat shift across the morphological range of the hybrid complex. Hence *Crataegus* populations in the region showed the same pattern of morphological variation and of geological and habitat preference that was found by Byatt in the Weald. Fig. 1 shows the proportion of each type in each population. The percentage of hybrids (as much as 40% in population 3 and 6) in chalkland populations suggests that both species were present here. Byatt (1975) found a similar situation in the Weald. She suggested that either hybridization had occurred between distant populations, or that these populations formerly contained *C. laevigata* and that introgression followed by strong directional selection had produced a *monogyna*-like population. For such a sudden change in selection pressure to operate there must have been considerable habitat change. It is possible that *C. laevigata* was formerly restricted to the clay-with-flints deposits which locally cap the chalk. However, Byatt found no *C. laevigata* in populations on the clay-with-flints, and it is unlikely that hybridization would occur between trees more than 30 metres apart (Grant 1971).

An alternative hypothesis might be put forward. Most chalkland sampling was done in hedgerows because very little *Crataegus* could be found in the beechwoods of the region. Since these hedges were almost certainly planted, it is likely that cuttings had to be brought from the clay vales due to the scarcity of suitable shrubs in the local woodlands for taking cuttings. The lowland trees may have come from pure or hybridized *C. laevigata* populations, in which case gene flow was due to man. However, there is some evidence (though slight) from Ashampstead Green (pop. 2) that *C. laevigata* may be derived from populations on the clay-with-flints. This woodland population lies on that deposit and shows a significantly lower hybrid index than the surrounding hedge trees (Table 2).

FACTORS AFFECTING FITNESS OF *C. MONOGYNA* AND *C. LAEVIGATA*

I am here concerned with the factors affecting habitat preference and the causes of introgression in the British Crataegi. Since fruit production in *Crataegus* gives a good measure of fitness I shall consider the effects of predation and habitat on fruit production as equivalent to their role in determining fitness although there are other components of fitness which have not been assessed.

TABLE 2. MEAN HYBRID INDEX VALUES BY HABITATS FOR 17 *CRATAEGUS* POPULATIONS IN THE UPPER THAMES VALLEY

Population	Substrate	Mean hybrid index			t value between wood and hedge
		Woodland	Hedge	Scrub	
1	limestone	0·89	0·84	—	0·74 ns
2	clay & flint	0·43	0·79	—	4·04 p<0·01
3	limestone	—	0·73	—	—
4	limestone	—	0·84	—	—
5	limestone	—	0·77	—	—
6	limestone	0·71	0·73	—	0·25 ns
7	sandstone	0·56	0·42	—	1·08 ns
8	limestone	0·83	0·75	—	1·18 ns
9	clay	0·65	0·88	—	2·78 p<0·05
10	clay	0·60	0·86	—	3·35 p<0·01
11	clay	0·44	0·42	0·87	0·14 ns
12	clay	0·55	0·89	0·88	40·20 p<0·001
13	clay	0·46	0·80	—	3·53 p<0·01
14	clay	0·49	0·76	—	2·46 p<0·05
15	clay	0·43	0·55	0·81	1·01 ns
16	clay	0·47	0·89	—	3·86 p<0·01
17	limestone	0·74	0·58	—	1·31 ns

Predation here refers to insect grazing damage to leaves and flowers, rather than fruit loss to birds and mammals which is largely beneficial in dispersing seed.

More than 100 invertebrate species are specifically associated with *Crataegus* in Britain (Pollard *et al.* 1974). Most of these are herbivores, feeding on fruits, flowers and leaves. Some, such as the hoverfly *Episyrphus balteatus* (Degeer), require pollen in their diet. The case-bearing caterpillar *Coleophora coracipennella* (Hübner) (Lepidoptera) also feeds on pollen. This moth larva burrows into young flower buds through one of the closed petals. Once inside, it feeds on the developing style, anthers and pollen. *Coleophora* may be detected in unopened buds by the small entry hole left near the base of one of the petals. A brief survey showed that as many as 20% of flowers on some *C. laevigata* in Open Magdalen Wood (pop. ref. 12) had been sterilised in this way. Predation was as high in some scrub *C. monogyna* trees in the same population.

Pollard *et al.* (1974) suggested that woodland edge and scrub trees maintained a greater diversity of invertebrates than did woodland trees. If true, *C. monogyna* might be under stronger selection pressure to evolve resistance to predators than is *C. laevigata*. In the present survey, insect damage was often observed as cavities in the leaf lamina in the vein axil region. This was equally frequent in both species although plants with an open sinus tended to be less damaged. Insect eggs were frequently found in the axils of leaf veins and, again, an open leaf sinus appeared to reduce this. Hence it is possible that the open leaf sinus, axillary hairs and possibly the cuticular wax of *C. monogyna* are adaptations to reduce insect grazing. To test whether insect grazing could influence future gene frequencies in the population through an effect on fecundity, I plotted the mean fruiting scores of the 171 mature (more than 24 years old) trees against their scores of insect grazing damage (see Methods). The results are presented in Fig. 4. There is a strong negative correlation between insect damage and fruit score ($r_{169} = -0{\cdot}342$, $P<0{\cdot}001$). Although this is highly suggestive, it is not clear whether this is a causal relationship nor indeed which might be the dependent variable. It is possible that the reduction in leaf area caused by selection for an open leaf sinus has reduced the ability of *C. monogyna* to colonise closed woodland habitats. Gosler (1981) found that for a given leaf length, *C. monogyna* leaves had a smaller lamina area and that the difference was greatest at the mean leaf length. Note also that the relationship is essentially similar in both the parental and hybrid morphs. However, although there is no significant difference in the mean grazing scores of the three morphs, the correlation was weaker in *C. monogyna* ($r_{85} = -0{\cdot}286$, $p<0{\cdot}01$) than in either the hybrids ($r_{45} = -0{\cdot}466$, $p<0{\cdot}001$) or *C. laevigata* ($r_{35} = -0{\cdot}407$, $p<0{\cdot}05$) and the slopes differed significantly (see Fig. 4B). This suggests that fruit production in *C. monogyna* was affected less by insect grazing than it was in the other taxa. This may help to explain the differences in fitness observed between the two species.

Table 3 shows the mean fruiting scores for mature trees of each parental type and hybrids in open and closed habitats on clay soils. In woodland there was no significant difference in fruit production between the parental species. In open habitats fruit production was significantly poorer in *C. laevigata* then in *C. monogyna*. However, *C. monogyna* showed a significant reduction in fruit production in woodland compared with that in open habitats whilst *C. laevigata* fruited significantly better in woodland than in open habitats. In both habitats hybrids were intermediate to the parental species in fruit production, although in open habitats *C. monogyna* trees were not significantly more productive than hybrids ($t_{18} = 1{\cdot}71$, n.s.). We may therefore expect selection to favour introgression

TABLE 3. FRUIT SCORES OF MATURE *CRATAEGUS* IN OPEN AND CLOSED HABITATS ON CLAY SOILS

	C. laevigata	hybrids	*C. monogyna*
Mean fruiting score	n=22	n=12	n=6
in woodland:	2·09±1·44	1·83±1·40	1·17±2·04
	Difference between parental sp. means	t_{26}=1·04 n.s.	
in hedges and scrub:	n=5	n=7	n=14
	0·5 ±0·84	2·86±1·78	4·07±0·83
	Difference between parental sp. means	t_{17}=8·18 p<0·001.	
t difference between	3·28 p<0·01	1·31 n.s.	3·36 p<0·01
habitats. d.f.:	25	17	18

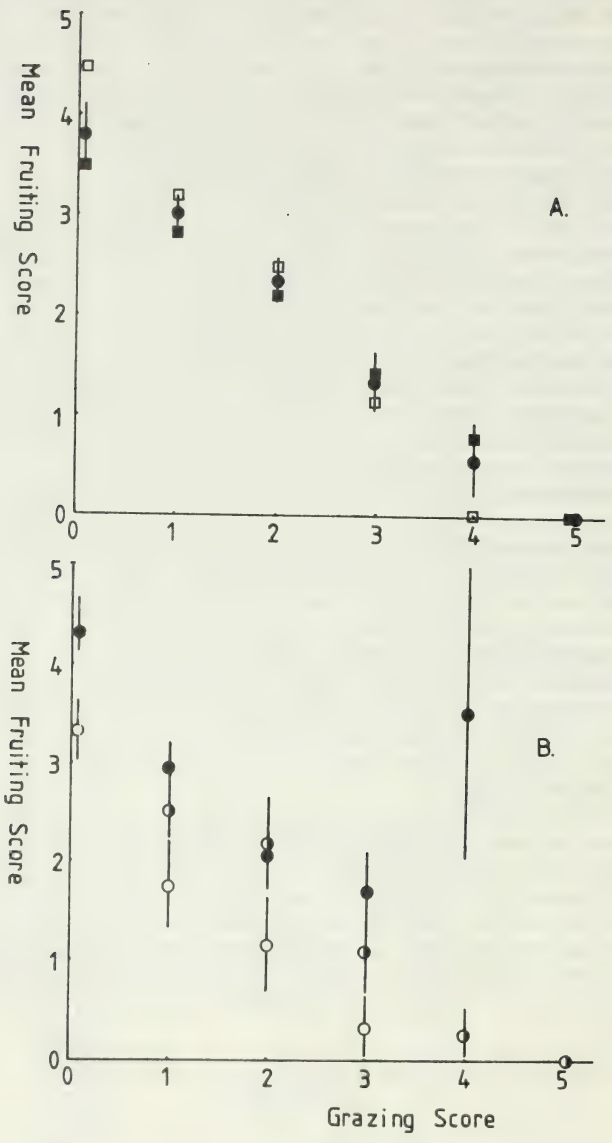

FIGURE 4. The relationship between insect damage (grazing) to leaves and fruiting score measured on 171 mature trees. A. shows the mean ± 1 S.E. for each grazing score for all trees combined (●). The regression of fruiting score on insect grazing was highly significant ($F_{1,169}$=21·93, $p<0·001$). In addition, the group means of populations on clays (■) and limestone (□) are also shown. B. shows the relationship between fruiting score and grazing damage in the two species and their hybrids separately. Means ± 1 S.E. are given for *C. laevigata* (○), for hybrids (◑), and for *C. monogyna* (●). The three were defined according to their hybrid index values (see methods). The regression equations for each were also significant ($F_{1,34}$ = 8·1, $p<0·01$; $F_{1,45}$ = 12·23, $p<0·01$; $F_{1,85}$ = 7·51, $p<0·01$ respectively). However, note that the slope for *C. monogyna* was significantly less than that of *C. laevigata* (t_{122} = 5·01, $p<0·01$); see text.

in woodland habitats but *C. monogyna* in open habitats, hence the question remains of why woodland populations on clay are not totally hybridized. Evidence that *C. laevigata* regeneration is occurring comes from an examination of the age structures of the populations.

Fig. 5 shows the age structure of the seventeen populations as kite diagrams. Each diagram shows the proportion of trees in each of the six age classes (see methods) together with the percentage of each type in each age class. Triangular diagrams with the apex at the top indicate a predominance of young plants in the population. These are mostly woodland populations with active regeneration. Triangular diagrams with the apex at the base show no regeneration and are largely hedge and scrub populations in which young plants are removed by grazing cattle or rabbits. The stable age distribution lies between these two extremes. These diagrams illustrate the changes that have taken place over time in the frequencies of the three groups in each population. Essentially four situations are suggested by these figures, although, as stated earlier, sample sizes dictate that some caution be exercised in the interpretation of these diagrams:

1. Populations showing approximately equal proportions of taxa with no changes over time, e.g. 6 and (to some extent) 15.
2. Populations in which hybridization has been extensive following the introduction of a second species, e.g. 3 and 7.
3. Woodland populations in which *C. laevigata* has been favoured over hybrids following introgression, e.g. 11, 13, and 16.
4. Scrub and hedge populations in which *C. monogyna* has been favoured over hybrids, e.g. 1 and 4.

Some indication of when introgression began is given by the age of the oldest hybrids in a population. Table 4 shows the age of the oldest trees in each population. Although these were rarely hybrids, Table 4 suggests that hybridization was initiated in most populations more than 50 years ago. Since hybrids do not dominate woodland populations this suggests that other factors are operating. The differences in age structure described above have probably resulted largely from differences in habitat and management policy. In many woodlands, coppicing was discontinued more than fifty years ago. This might explain the small number of recently hybridized populations in the area.

Since coppicing affects the woodland trees more than those of the surrounding hedge or woodland edge, it has undoubtedly reduced the fecundity of *C. laevigata* relative to *C. monogyna*. Coppicing may have a long-lasting effect on trees. To assess the effect of coppicing on fruit production, fruit scores were standardized for tree age, the openness of the habitat, and insect damage using the regression equation:

Fruit score = 0·323 + 0·0276 Age − 0·454 Insect + 0·669 Habitat

This equation was derived from a stepwise multiple regression analysis in which these predictors each explained a significant proportion of the variation in fruit score (together with tree habit explaining 30·23% in all). The mean fruiting score for uncoppiced trees, after standardizing for age, habitat and grazing damage was 1·86±0·93 (n=159), significantly higher than that for coppiced and pollarded trees of 1·43±1·05 (n=104) (t_{261}=3·33, $p<0·001$). However, this might be compensated for partly by the tendency for coppicing to increase the tree's longevity (Rackham 1987). In the present study the mean age of coppiced boles in woodland was 52·5±31·5 (n=78) which was

TABLE 4. THE AGE OF THE OLDEST TREES IN *CRATAEGUS* POPULATIONS OF THE THAMES VALLEY

Age of oldest trees (yrs) (grouped into classes)	Number of populations		
	C. laevigata	hybrids	*C. monogyna*
0–15	0	0	0
16–30	2	0	0
31–50	3	4	6
51–75	3	6	2
76–100	2	1	2
101+	3	6	1

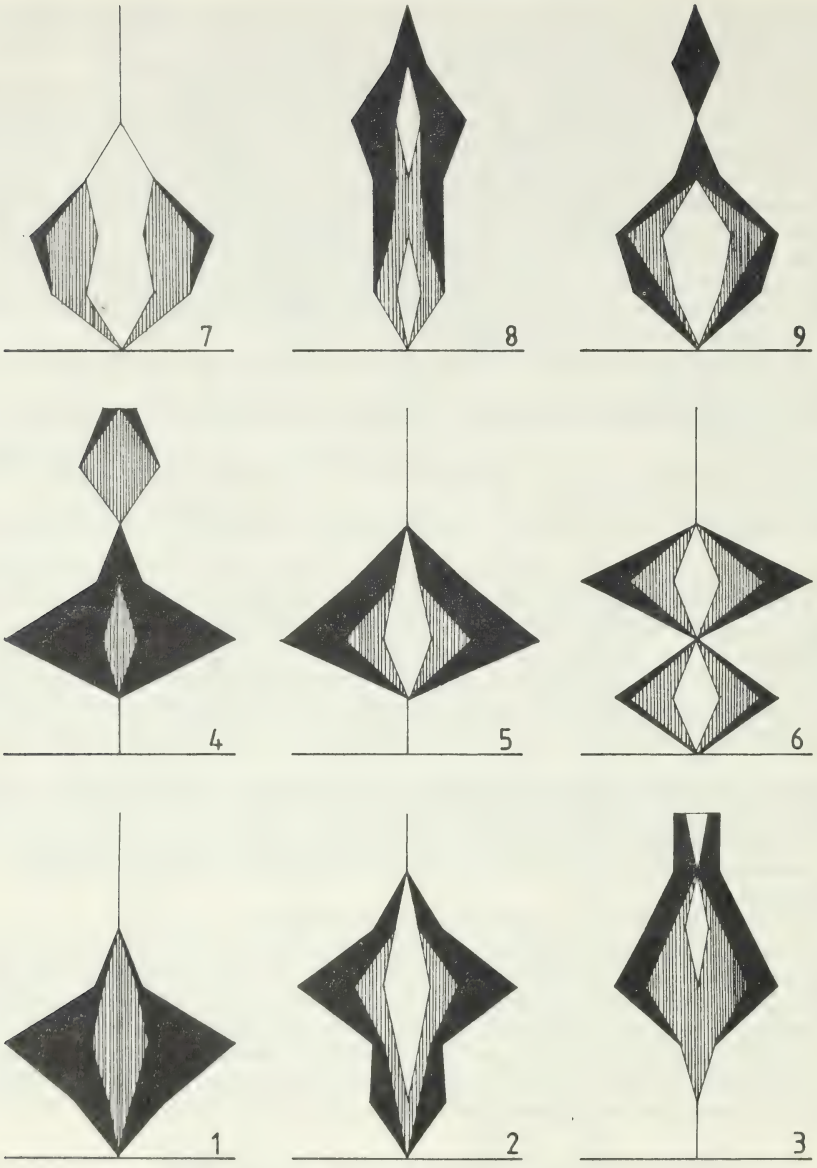

FIGURE 5. Kite diagrams showing the age structure of 17 *Crataegus* populations. Each diagram shows the percentage of all specimens in a given age class, and the percentage of each type in each age class. The final diagram is a key. See text for further details.

significantly older than the mean for unmanaged woodland trees of 26·1±20·6 (n=33) (t_{109}=4·45, $p<0.001$). However, these results are biassed by the fact that coppicing was discontinued many years ago in most populations, so that the effect of coppicing on longevity cannot be assessed with confidence.

Table 2 shows the mean hybrid index values for open and closed habitats in each population. In most woodland populations on non-calcareous soils there is a significant difference between index values in the wood and in the surrounding boundary hedge. However in populations 7, 11 and 15

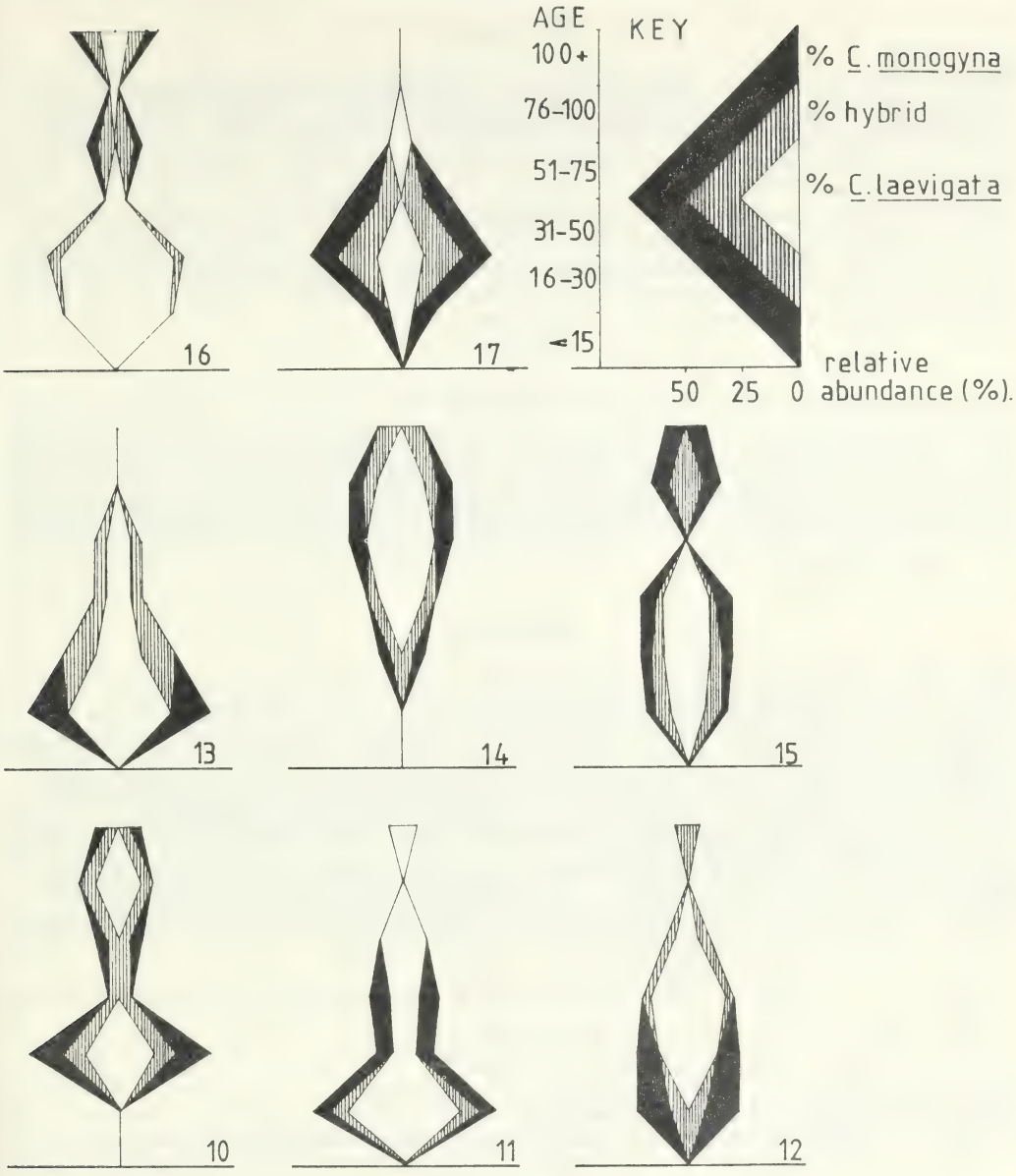

FIGURE 5. *continued.*

which are old woodlands, surrounded by ancient hedges with high shrub diversity suggesting great age (Pollard *et al.* 1974) and therefore probably planted from cuttings taken from within the wood, there was no significant difference and the low hybrid index values supports the view that *C. laevigata* is indicative of an old hedge (Bradshaw 1971). Most chalkland woodland populations have undoubtedly developed from hedges as they show no difference in morphology from the planted hedge populations. This is particularly well illustrated by the age structure of the Highland Wood population (6) in Fig. 5. Here a young woodland population has grown up from seed from a nearby hedge (this may be assumed as the next nearest *Crataegus* source was over 1 km away) on the edge of a Beech wood. The frequencies of *Crataegus* taxa in the hedge and woodland were identical.

CONCLUSION

Crataegus laevigata and *C. monogyna* are adapted both anatomically and ecologically to distinct habitats but hybridize readily where their ranges overlap in the Upper Thames Valley. However, in many hybridizing populations, hybrids have not replaced the parental species totally. Two principal factors have contributed to the introgression of *C. monogyna* genes into *C. laevigata* populations in the Upper Thames Valley. These are extensive woodland coppicing, which has reduced the fecundity of the woodland *C. laevigata* trees both in the short and longer term, and the planting of *C. monogyna* boundary hedges. The cessation of coppicing in most woodland populations has allowed some slow return to the original frequencies of the species in many woods. This contrasts with Byatt's (1975) study of introgression in the Weald which predicted a general breakdown in recognisable specific boundaries in these two species.

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REFERENCES

Anderson, E. (1949). *Introgressive hybridization*. New York.
Bowen, H. J. M. (1968). *The flora of Berkshire*. Reading.
Bradshaw, A. D. (1953). Human influence on hybridization in *Crataegus*, in Lousley, J. E., ed. *The changing flora of Britain*, pp. 181–183. Oxford.
Bradshaw, A. D. (1971). The significance of Hawthorns, in *Hedges and local history*, pp. 20–29. London.
Browicz, K. (1972). *Crataegus* L., in Davis, P. H., ed. *Flora of Turkey* **4**: 133–147. Edinburgh.
Byatt, J. I. (1975). Hybridization between *Crataegus monogyna* Jacq. and *C. laevigata* (Poiret) DC. in south-eastern England. *Watsonia* **10**: 253–264.
Clapham, A. R., Tutin, T. G., & Warburg, E. F. (1962). *Flora of the British Isles*, 2nd ed. Cambridge.
Franco, J. (1968). *Crataegus* L., in Tutin, T. G. *et al.*, eds. *Flora Europaea* **2**: 73–77. Cambridge.
Gosler, A. G. (1981). *Introgressive hybridization between* Crataegus laevigata *(Poiret) DC. and* C. monogyna *Jacq. in the Upper Thames Valley*. M.Sc. thesis, University of Reading.
Grant, V. (1971). *Plant speciation*. New York.
Holmes, S. C. A., & Wilson, V. (1960). In Sherlock, R. L. *British regional geology: London and Thames Valley*, 3rd ed. London.
Pollard, E., Hooper, M. D., & Moore, N. W. (1974). *Hedges*. London.
Rackham, O. (1987). *The history of the countryside*. London.
Sokal, R. R., & Rholf, F. J. (1981). *Biometry*, 2nd ed. San Francisco.
Stearn, W. T. (1973). *Botanical Latin*. Newton Abbot.
Williams, L. R. (1989). *Crataegus* × *media* Bechst. in Middlesex hedgerows. *Watsonia* **17**: 364–365.

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Hypericum × *desetangsii* Lamotte nm. *desetangsii* in Yorkshire, with special reference to its spread along railways

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ABSTRACT

Records for *Hypericum* × *desetangsii* nm. *desetangsii* for Yorkshire are given, with an account of the distribution of the parental species, *H. perforatum* L. and *H. maculatum* Crantz, in the county. In Yorkshire, the hybrid has almost always been found in the absence of both parental species and only occasionally with *H. perforatum* L. The hybrid is very variable, particularly in the case of populations on railways sites. A hybrid index has been used to assess the degree of hybridity in individual plants. The distribution of the hybrid and its backcrosses is discussed. The introduction of the hybrid onto railway sites may have been followed by backcrossing with *H. perforatum* and in the course of time some taxa may have been lost.

INTRODUCTION

Prior to 1987, *Hypericum* × *desetangsii* Lamotte nm. *desetangsii* (*H. maculatum* Crantz subsp. *obtusiusculum* (Tourlet) Hayek × *H. perforatum* L.) was believed to be rare in Yorkshire, v.cc. 61–65, having only been recorded ten times (Crackles 1986).

Whilst staying in Ilkley, GR 44/11.47, in mid-May, 1987, I tentatively identified the hybrid by vegetative features at a quarry near Burton Leonard, GR 44/32.63, and on three sites adjacent to railway stations on the Leeds to Ilkley railway line. Identification of plants from these sites was confirmed in the flowering season, except for those at Burley-in-Wharfedale which were cut before they had a chance to flower. Interest having been aroused, additional localities for *H.* × *desetangsii* have been found in the Ripon area, GR 44/3.6 & 44/2.7, and along railways in v.cc. 61, 62 and 64 during 1987 and 1988. Details of these records are given below and in the forthcoming Flora of v.c. 61.

RECORDS

N.E. YORKS., V.C. 62

Railway records: One plant in the disused Pilmoor Junction station and a continuous belt, stretching some 30 m, along the immediately adjacent main York to Edinburgh line GR 44/4.7, 1988, *F. E. Crackles (F.E.C.) & J. E. Duncan (J.E.D.)*. See also the Yorkshire Naturalists' Union's annual report (1973).

MID-W. YORKS., V.C. 64

Non-railway records: Low Grass Wood, Grassington GR 34/9.6, 1988, *H. Lefevre (H.L.)*; open woodland, north-west of Ripon GR 44/2.7, 1987, *D. E. Haythornthwaite (D.E.H.)*; quarry, Burton Leonard GR 44/3.6, 1987, *F.E.C.*; Quarry Moor, near Ripon GR 44/3.7, 1972, *D.E.H.*, det. N.K.B. Robson, see also *The Naturalist*, p. 112 (1976). Railway records: disused line, near Threshfield GR 34/9.6, 1987, *H.L.*; Embsay station GR 44/0.5, 1987, *J.E.D.*, det. N.K.B.R.; areas adjacent to Ilkley and Ben Rhydding stations GR 44/1.4, 1987, *F.E.C. & J.E.D.*; Guiseley station GR 44/1.4, 1987, *J.E.D.*; along the disused Harrogate to Ripon line near Bishop Monkton GR 44/3.6, 1987, *D.E.H.* and at Littlethorpe GR 44/3.6, 1988, *F.E.C. & J.E.D.*; in quantity by the main line between York station and Dringhouses sidings GR 44/5.4, 1981, *T.F.Medd.*

N.W. YORKS., V.C. 65

There are no railway records. By R. Swale, above Richmond GR 45/1.0, 1968, *J. A. Gilleghan*. Additional records are given in Sledge (1961) and *The Naturalist* **104**: 70 (1979).

DISTRIBUTION OF PARENTAL SPECIES

Hypericum maculatum Crantz subsp. *obtusiusculum* (Tourlet) Hayek appears to have been always very uncommon in Yorkshire. Perring & Walters (1962) gave the species as having occurred in eight 10-km squares. Watson (1883) gave v.c. 61 in the list of vice-counties in which the species had occurred, but no details have ever come to light and there have been no later records. Baker (1863) stated that the species was "much less frequent" in N. Yorkshire than *H. perforatum* and cited seven localities, mainly in hilly country. Lees (1888) described the species as occurring in bushy places, mainly by water courses, "rare, although plentiful enough in certain areas". He included a record for a stone quarry at Hutton, to the north-east of Ripon, GR 44/3.7, one of the 10-km squares in which the hybrid has been found in recent years. Since 1945, there have been nine Yorkshire records for *H. maculatum*, in Annual Botanical Reports in *The Naturalist*, one for v.c. 62, five for v.c. 63, two for v.c. 64 and one for v.c. 65, but none for a 10-km square for which the hybrid has been recorded, with the possible exception of the record for Langton-on-Swale, GR 44/2.9, v.c. 65 (Sledge 1961). Two additional 10-km square records for v.c. 65 are given in Perring & Sell (1968), the specimens in both cases having been examined by N. K. B. Robson.

Hypericum perforatum L. is widely, but unevenly distributed in Yorkshire (Perring & Walters 1962), being common in many areas.

OCCURRENCE OF THE HYBRID IN RELATION TO THAT OF THE PARENTAL SPECIES

In most Yorkshire localities, the hybrid has not been found in the presence of both parents. *H. perforatum* was also present in five localities: Embsay station GR 44/0.5; woodlands north-west of Ripon GR 44/2.7; disused line, Bishop Monkton GR 44/3.6; Guiseley station GR 44/1.4 and Water Fulford GR 44/6.4 and was often introgressed. Only at Langton-on-Swale, GR 44/2.9, were both parents recorded as present in the same area, but the presence of *H. maculatum* was later questioned (Sledge 1961). The hybrid and *H. maculatum* are recorded for the same 10-km square only in the Ripon and Richmond areas (10-km squares 44/3.7 and 45/1.0).

VARIABILITY OF THE HYBRID

I have examined at least one specimen of the hybrid from each Yorkshire site where it has been found since 1986. The specimens, particularly from railway sites, are so variable that a hybrid index was developed to assess the degree of hybridity in each case. The method of scoring, using only those characters generally accepted as those of the F_1 hybrid (Robson 1981), is given in Table 1. A summary of the results of hybrid index analysis of specimens examined is given in Figs 1 & 2.

Most plants of a population of *H.* × *desentangsii* on a roadside verge near Arnold in Holderness, v.c. 61, conform fully to the description of the F_1 hybrid as do populations on three railway sites. Populations on three sites in the Ripon area including that on the disused line near Bishop Monkton and cultivated plants grown in a garden near Knaresborough and which originated from Quarry Moor, near Ripon, are generally similar to each other and have a high score in the hybrid index analysis (score 6–8). However, the sepals instead of being blunt and apiculate are usually acute and attenuate, but nevertheless broad and erose-denticulate. In some such specimens, the occasional sepal may be blunt and apiculate. It should be noted in this connection that plants of the hybrid found near Langton-on-Swale in 1960 had lanceolate sepals which were pointed (Sledge 1961).

First generation hybrids were found immediately adjacent to the platform at Guiseley station and on the same railway line near to Ilkley station. Near Guiseley station there was also a population of *H. perforatum* and another showing some signs of hybridity (score 4). Specimens from the Ilkley station car park (formerly the station yard) and the population immediately behind the platform at

TABLE 1. METHOD OF SCORING THE HYBRID INDEX

Character	*Hypericum maculatum* Score 2 (or 1)	Intermediate Score 1	*Hypericum perforatum* Score 0
Leaves	No pellucid dots or a few on upper leaves only	Lowest leaves with no pellucid dots	All leaves with pellucid dots
	Densely reticulate venation	Distinct, laxly reticulate venation	Inconspicuous minor veins
Stems	Stem square for its full length	Signs of 2nd pair of lines or incomplete square-stemming	Two raised lines only
Sepals			
Width	Wide	Intermediate	Narrow
Apex	Obtuse and rounded	Some sepals obtuse and apiculate	Acute
Margin near apex	Erose-denticulate	Slightly erose-denticulate	Entire
Petals	Black lines (score 1)		

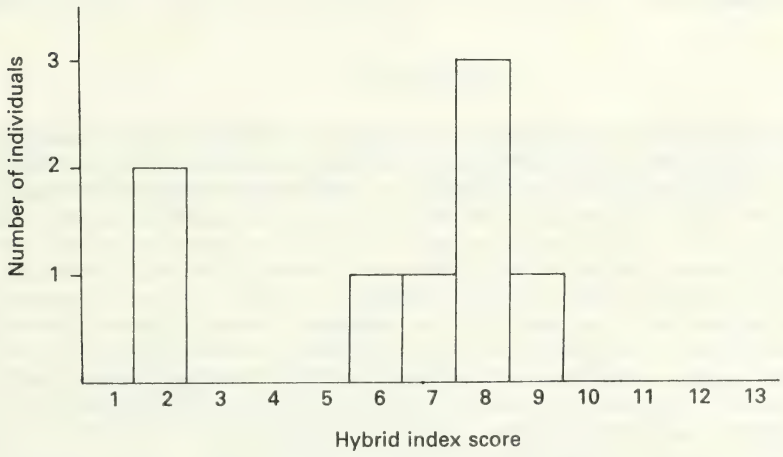

FIGURE 1. Histogram of the hybrid index scores for populations sampled on non-railway sites.

Bed Rhyddiang station, 1·5 km west of Ilkley, were backcrosses (score 5–6). Most sepals are acute, occasional ones obtuse and erose, with sparse denticulation. N. K. B. Robson examined two specimens from Embsay station, on the former Skipton to Threshfield line, a branch of the Leeds to Ilkley line. Both specimens had numerous pellucid dots on their leaves. One specimen had "rather broad sepals with the apex apiculate and erose-denticulate" whilst the second specimen had "acute entire sepals". Both had "black glandular lines on the petals found in *H. maculatum* and more reticulate veins than is usual in *H. perforatum*". These specimens had a hybrid index score of 6 and 3 respectively. Near Threshfield, on a disused section of the same line, Miss H. Lefevre found plants with few pellucid dots on the leaves and sepals which were narrow and acute, but erose and denticulate (score 6).

Plants believed to be introgressed *H. perforatum*, with one or two hybrid features only, have been found with good intermediates at Bishop Monkton and at Embsay and Guiseley stations; they also occur in the absence of the hybrid in a gravel pit and on a waste place near Ilkley and on a disused

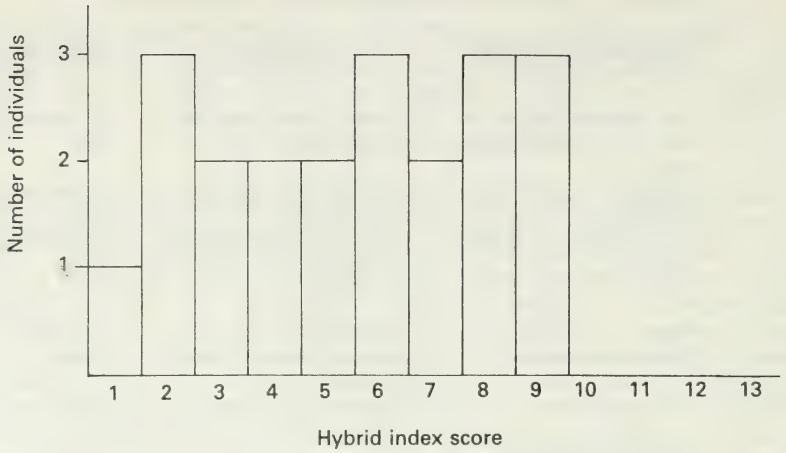

FIGURE 2. Histogram of the hybrid index scores for populations sampled on railway sites.

railway line at Deighton, GR 44/6.4, v.c. 61. Introgressants in the Ilkley area are the only ones found on non-railway sites.

DISCUSSION

The widespread occurrence of *Hypericum* × *desetangsii* in Yorkshire almost invariably in the absence of one or both parents is of considerable interest. The occurrence of the hybrid in such circumstances is possible owing partly to a capacity for limited vegetative propagation and partly to its fertility (Robson 1975). The presence of the hybrid may indicate that both parental species once occurred in the area. Near Arnold in Holderness, GR 54/1.3, the hybrid occurs on a remarkable species-rich roadside where both calcicoles, calcifuges and species of both well-drained and wet soils are to be found, including *Achillea ptarmica*, *Anemone nemorosa*, *Avenula pubescens*, *Carex spicata*, *Filipendula ulmaria*, *F. vulgaris*, *Lathyrus montanus*, *Lotus uliginosus*, *Ononis spinosa*, *Serratula tinctoria*, *Silaum silaus*, *Succisa pratensis* and *Trifolium medium*. With the exception of the plants at Littlethorpe, the populations in the Ripon area (i.e. in 10-km grid squares 44/2.7, 44/3.6 and 44/3.7) are similar, suggesting a common origin. Plants on the stretch of the disused Harrogate to Ripon line near to Bishop Monkton appear to relate to the non-railway hybrid populations in the area. This stretch of disused line is being managed as a nature reserve, its vegetation being regarded as relict grassland of a type present in the district before the railway was constructed. Species present include: *Avenula pubescens*, *Blackstonia perfoliata*, *Bromus erectus*, *Dactylorhiza fuchsii*, *Knautia arvensis*, *Origanum vulgare*, *Pimpinella major*, *P. saxifraga*, *Rhinanthus minor*, *Silaum silaus* and *Trifolium medium*. *H. maculatum* is known to have occurred at some time near to both Ripon and Richmond, in 10-km grid squares 44/3.7 and 45/1.0 respectively.

The hybrid tends to occupy habitats intermediate in wetness between those of the parents, which do, however, have overlapping habitat requirements. It is possible that there has been some loss of suitable habitats for *H. maculatum* in the course of time, whilst environmental changes may have favoured the survival of the hybrid. The presence of the hybrid on so many railway sites in districts where *H. maculatum* has never been found leads one to the conclusion that the hybrid has been introduced along the railways by air movement generated by trains or by other railway activity.

Backcrossing from the hybrid occurs readily in both directions, thus producing a more or less continuous range of variants between the parental species (Robson 1981). Variants of the hybrid, other than F_1s, found along railways in Yorkshire are consistent with these being backcrosses to *H. perforatum*. Introduced first generation hybrids may have come into contact with *H. perforatum* growing along the line and backcrossed with it, as seems to have happened at Guiseley station.

Further away from the point of introduction, one might expect backcrossing to be more pronounced, as it is at both Embsay and Threshfield. Hybrids on disused lines must have been there since the days of the steam-train, indicating that the present situation has arisen over a long period of time during which taxa may have been lost. It is also possible that the initial introduction may have been a backcross or an introgressant.

The fact that the *Hypericum* × *desetangsii* has been found in quantity along the York–Newcastle–Edinburgh line and by the main York–Doncaster–London line suggests that its spread along railways is unlikely to have been confined to Yorkshire.

There are records for the hybrid for railways in other parts of Great Britain. It is significant that in 'Plant Records' in *Watsonia*, there are first vice-county records for disused railway lines in Montgomery, v.c. 47, and Merioneth, v.c. 48, both in 1971 and in Roxburghshire, v.c. 80, in 1975 and a second vice-county record at Crediton station in Kircudbrightshire, v.c. 73, in 1977.

The hybrid is known to have occurred in close proximity to both parental species on the disused Waverley line (M.E. Braithwaite pers. comm.) at Acreknowe, GR 36/5.0, and at Longnewton, GR 36/5.2 (Braithwaite 1975). The Waverley line formerly connected Hawick with Edinburgh and was also linked to Carlisle and Newcastle.

There is no doubt that *H.* × *desetangsii* has been overlooked in Yorkshire even on a nature reserve. Detection of backcrosses requires care. The examination of a single leaf is not enough. In some hybrid plants, median leaves may have many perforations and exceptionally all leaves may have pellucid dots, so that sepals should also be examined. It should also be remembered that all the plants of a population may not have the same combination of characters.

May I suggest that botanists should examine all railway populations of St. John's Worts critically and publish their observations and so help to throw further light on this intriguing story.

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I wish to thank Dr N. K. B. Robson for much useful discussion and valuable comments on my observations. I am also indebted to Mrs J. E. Duncan, Mrs D. E. Haythornthwaite and Miss H. Lefevre for providing specimens, and to T. F. Medd for providing information and copies of correspondence.

REFERENCES

Baker, J. G. (1863). *North Yorkshire – studies of its botany, geology, climate and physical geography*. London.
Braithwaite, M. E. (1975). *A railway flora of Teviotdale*. Hawick.
Crackles, F. E. (1986). Botanical comment 4. How came they? *Yorks. Nats. Union Bulletin*, No. 6: 5–7. York.
Lees, F. A. (1888). *The flora of West Yorkshire*. London.
Perring, F. H. & Sell, P. D., eds (1968). *Critical supplement to the Atlas of the British flora*. London.
Perring, F. H. & Walters, S. M., eds (1962). *Atlas of the British flora*. London.
Robson, N. K. B. (1975). *Hypericum* L. in Stace, C. A., ed. *Hybridization and the flora of the British Isles*, pp. 164–167. London.
Robson, N. K. B. (1981). *Hypericum* × *desetangsii* Lamotte in Wigginton, M. J. & Graham, G. G. *Guide to the identification of some of the more difficult vascular plant species*. Banbury.
Sledge, W. A. (1961). *Hypericum* × *desetangsii* Lamotte in Yorkshire. *The Naturalist*, pp. 43–44. Hull.
Watson, H. C. (1883). *Topographical botany*, 2nd ed. London.

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The rare plants of the Howardian Hills, North Yorkshire, 1794–1988

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ABSTRACT

The lists of rare plants growing in the Howardian Hills compiled by Robert Teesdale and Henry Ibbotson have been pooled to provide a picture of the plant life in the area for the period 1794–1843. Modern records have been examined and extensive field work carried out to determine the fate of the rare plants post-1943. The *Atlas of the British flora* was used to provide an objective definition of rarity. Woodland species have shown the greatest survival; plants of other habitats, including arable, showed the poorest survival; plants of 1) grassland, 2) aquatic habitats and river margins, and 3) mire occupy intermediate positions. The number of sites occupied by surviving species has declined. Two very rich sites, Terrington Carr and Malton Fields, have each lost 100% of their rare flora. Extinctions appear to be due to changes in land use rather than any other factors, emphasising the need for conservation of threatened habitats, especially arable ones. This insight into the plant-loss/land-use relationship is only possible because accurate site records were made by Teesdale and Ibbotson.

INTRODUCTION

The great expansion of field botany in the nineteenth century led to the recognition of several classic areas in the British Isles which contained a particularly rich diversity of rare plants (Gilmour & Walters 1972; Allen 1986; Noltie 1986). Some of these areas have maintained their complement of rare species through to the present decade with little or no significant loss, e.g. The Breck (Trist 1979); The Burren (Webb & Scannell 1983); The Lizard (Margetts & David 1981); Teesdale (Clapham 1976). Others, on the other hand, have undergone radical transformation with a major loss of the rare flora, e.g. the Huntingdonshire Fens (Sheail & Wells 1980, 1983). The third alternative is a progressive reduction of the floral interest as component habitats are modified or destroyed in a piecemeal fashion. A short, preliminary account of this process has been previously published for the Howardian Hills, North Yorkshire (Gulliver 1985). This area, though comparatively little-known today, was botanically famous in the nineteenth and early twentieth century; Baker (1907) wrote "The Howardian tract furnishes a great variety of situation and although it has none of the more decidedly montane plants, yet we obtain here as many of the rare species as are to be found anywhere in North Yorkshire within an equal area, with the exception of Upper Teesdale, as the following list [not included here] will testify." An account of the fate of this rare flora follows hereafter.

THE STUDY AREA

The Howardian Hills form a distinct area c. 15 km north-east of York and take their name from the presence therein of Castle Howard. Their location is shown in Fig. 1. The Howardian Hills Area of Outstanding Natural Beauty (A.O.N.B.) includes a zone of land to the north and west of the hills themselves, to allow the A.O.N.B. to be contiguous with the North York Moors National Park. This north-western zone of the A.O.N.B. has been excluded from the botanical study area, which otherwise follows the boundary of the A.O.N.B. with the exception of the small area of high ground immediately west of Malton, which has been included (see Fig. 1). Most of the area is on the north-western side of the river Derwent, and therefore falls into v.c. 62; but that part south-east of the Derwent is in v.c. 61.

FIGURE 1. The boundaries of the study area and the Howardian Hills Area of Outstanding Natural Beauty.

The small scale of the landscape has the consequence that there is a rich mosaic of habitats. The Jurassic deposits of limestones (sometimes sandy limestones) have produced infertile pastures and light arable lands, both of which were once rich in native plant species, though Oxford Clay deposits do also occur. The limestone has also produced base-rich waters which formerly fed mire systems, allowing acidic peat (above the water table) and base-rich peat (below the water table) to exist in very close proximity. The presence of several large estates has aided the continued survival of many large woodlands. Quite a few of the parishes within the Howardian Hills were not enclosed until the late eighteenth or early nineteenth century, hence ensuring that old-fashioned arable practices, which favoured the presence of arable weeds, persisted in the area. All the above features contributed to the botanical richness of the area.

SOURCE OF PLANT RECORDS

A list of the rare plants of the Howardian Hills was published by Robert Teesdale in 1794 and was followed by a short supplement (Teesdale 1794, 1800); a second list was published quite independently by Henry Ibbotson in 1843 (Ibbotson 1843). Some biographical details of these two botanists are to be found in Rob (1963) and Crackles (1967) for Teesdale, and Gulliver (1979) for Ibbotson. In this study the two lists have been pooled, and all subsequent records of the species examined; see Appendix I for details. During this process it was evident that post 1843 records for Gramineae, Cyperaceae, ferns and mosses were extremely scarce; and therefore attention was focused on spermatophytes but excluding the grasses and sedges. (Ibbotson's second list of 1844 described mosses.) Both Teesdale and Ibbotson described the plants they listed as rare. However the use of the *Atlas of the British flora* (Perring & Walters 1962; Perring & Sell 1968), does allow an objective assessment of plant rarity to be made. The 100-km square 4/4, which includes the Howardian Hills, has been employed, and all species on the pooled Teesdale and Ibbotson (T. & I.) lists present post-1930 in thirty or fewer 10-km squares have been considered to be regionally rare and used in this investigation. Species present in fifteen or fewer 10-km squares in 4/4 have been additionally designated regionally very rare. Those species on the T. & I. lists but present in more than thirty 10-km squares will be referred to as residual species. For a brief, early account of the

study using all the entries on the T. & I. lists see Gulliver (1985). One major feature of both the T. & I. lists is that site information is given for virtually every species listed. However occasionally this information was omitted, and such species have not been included in this investigation, as one cannot be absolutely certain that they did actually grow in the study area. In addition the micro-species of *Rubus* and *Hieracium* have been excluded.

The published and manuscript records of plants in the Howardian Hills decline a little through the 19th century, reach a trough in the 1920s and 1930s, and then rise somewhat after the second world war. Accordingly the two best recorded periods have been compared, i.e. 1794–1843 with 1943–1988. Since 1976 extensive fieldwork in the area has been carried out by the author and his wife; examples of all the habitat types have been examined, and each part of the hills visited. Significant rediscoveries include *Trollius europaeus* at Scackleton Low Moor, *Convallaria majalis* at Wath Wood, *Gagea lutea* at Stittenham Wood and *Paris quadrifolia* in Coldwell Plantation, all these being long-lived perennials, strongly shade tolerant (or moderately so in the case of *Trollius europaeus*). In the course of field work one site was discovered with several regionally rare species which has since been designated a Site of Special Scientific Interest and a Yorkshire Wildlife Trust Nature Reserve. Names and designations of native status follow Clapham *et al.* (1987). As the seeds of many wild plants can survive in a dormant state in the soil for decades, no scrutiny of any one area can ever be absolutely comprehensive, though the present study has been both carefully and thoroughly executed. Fieldwork is continuing to establish the current validity of those records from the 1940s and 1950s. The theme of the study is not an investigation of a single species (cf. Foley 1987), but the use of the records of many species to detect trends within habitats and within the study area as a whole.

DESIGNATION OF HABITAT CATEGORY

The original site descriptions in the T. & I. lists have been used to assign species to habitat categories, though sometimes this does result in a species being allocated to a category which may seem anomalous at the national level, e.g. *Atropa bella-donna* under arable.

The categories of woodland and arable are self-explanatory. However there is a continuous gradation amongst wetland plants from totally submerged aquatics, right through to terrestrial species tolerant of damp soils. Haslam *et al.* (1975) has therefore been used as the basis for designation to the aquatic habitats and river margins category, together with the following species: *Bidens cernua*, *Hottonia palustris*, *Rorippa islandica*, *Sium latifolium*, *Stellaria palustris*.

Species occuring in wet, peaty sites with acid ground water were assigned to the mire category. All such species had Terrington Carr as at least one of their stations. One mire species, *Utricularia minor*, is included in Haslam *et al.* (1975).

The residue of species were placed in the other habitats category. This does include some species which are border-line cases, e.g. *Helleborus viridus* from a ditch bank rather than from woodland and similarly with *Prunus padus* from hedges; *Lythrum portula* from a damp area rather than aquatic habitats; and *Empetrum nigrum* from heathland ('other habitats') rather than mire.

RESULTS

OVERALL FINDINGS

Woodland species show the greatest overall percentage survival and arable species the least; see Table 1. Taking the mean survival figure of 38% as a guide; survival is greater than average in both grassland (47%) and woodland (72%); and is markedly lower in both 'other habitats' (22%) and arable (16%); with aquatic habitats and mire occupying positions near the average with 37% and 33% survival respectively.

25 of the 44 regionally rare species (pooled over all habitat categories) were still in evidence post-1943, a survival rate of 56%. Conversely only 17 of the 71 very rare species were still present, a survival rate of 24%. Carrying out a chi-square statistical test on the data reveals that this difference in survival rates between the two rarity categories is very highly significant ($\chi^2 = 12{\cdot}66$, 1 d.f.). Hence those species which were least common in the region as a whole were more likely to become

TABLE 1. THE PRESENT-DAY (i.e. POST-1943) NUMBERS OF RARE, NATIVE PLANTS OF THE HOWARDIAN HILLS, NORTH YORKSHIRE, ARRANGED BY HABITAT CATEGORIES

Rare plants are those spermatophytes recorded by Teesdale (1794, 1800) and Ibbotson (1843) which now occupy up to 30 10-km squares in the 100-km square 4/4 (Perring & Walters 1962); excluding Cyperaceae and Gramineae. See also Appendix 2.

	Woodland	Grassland	Aquatic habitats & river margins	Mire	Other habitats	Arable	Total
CONFIRMED							
Regionally rare[a]	7 (39%)	6 (35%)	4 (16%)	2 (22%)	3 (11%)	3 (16%)	25 (22%)
Regionally very rare[b]	6 (33%)	2 (12%)	5 (21%)	1 (11%)	3 (11%)	0 (0%)	17 (15%)
Total	13 (72%)	8 (47%)	9 (37%)	3 (33%)	6 (22%)	3 (16%)	42 (37%)
UNCONFIRMED, ASSUMED EXTINCT							
Regionally rare[a]	1 (6%)	5 (29%)	5 (21%)	1 (11%)	3 (11%)	4 (21%)	19 (16%)
Regionally very rare[b]	4 (22%)	4 (24%)	10 (42%)	5 (56%)	19 (67%)	12 (63%)	54 (47%)
Total	5 (28%)	9 (53%)	15 (63%)	6 (67%)	22 (78%)	16 (84%)	73 (63%)
Grand Total	18	17	24	9	28	19	115

[a] present in 16–30 10-km squares in 100-km square 4/4
[b] present in 0–15 10-km squares in 100-km square 4/4

extinct in the Howardian Hills. Rarity at the regional level will often be due to very restricted habitat requirements, which in turn will make the species more vulnerable to small changes in environmental conditions.

Looking at the interaction between habitat type and level of rarity (upper part of Table 1) one important trend emerges. The comparatively low incidence of regionally very rare species (and corresponding high incidence of regionally rare species) in the grassland habitat is statistically signficant ($\chi^2 = 4{\cdot}65$, 1 d.f.). Hence the grassland habitat does show a real deficiency in very rare species compared with the pattern for all other habitats (pooled). This phenomenon is probably due to the once widespread occurrence of species-rich grassland, with the consequence that uncommon species were unlikely to be very rare as there would have been several suitable individual sites throughout the region. This situation may well have changed radically since the 1950s when field survey work for the *Atlas* (Perring & Walters 1962) was carried out.

The total of 73 extinct species does include six *British Red Data Book* species (Perring & Farrell 1983). None of the 42 confirmed taxa are *B.R.D.B.* species.

The balance of survival in the different habitat categories (Table 1) is markedly different from that in Bedfordshire, where Dony (1977) studied extinction rates for the entire vice-county flora in eleven habitat categories. In Bedfordshire, marsh showed the highest extinction rate (35·3%) and acid pasture the next highest (19·0%). The arable extinction rate of 10·7% was fifth in rank. The extinction rate of woodland taxa was 5·3%, seventh in rank. Overall survival was best amongst hedgerow species (1·5% extinction) and riverside plants (1·6% extinction). The alien species category has been excluded from the foregoing comparisons, following Dony (1977).

Conceivably woodlands have suffered a greater degree of change in Bedfordshire; and the arable flora was possibly less well recorded in the early years than in the Howardian Hills.

SPECIES DECLINE

A further measure of changes that have taken place in the area is provided by examining the reduction in the number of sites occupied by those species that do survive. Thus *Trollius europaeus* has been lost from the three sites where it was formerly recorded (using all available 19th century records), but discovered in 1984 at a fourth. Similarly *Coeloglossum viride* has become extinct at its

five former sites, but located post-1943 at a sixth; and *Vicia sylvatica* is now only known from one of its six former stations in the hills.

A parallel picture emerges for several of those species now extinct in the area, for example *Neottia nidus-avis* has declined from five sites to zero and *Orchis ustulata* from four to zero in the Howardian Hills.

LOSSES AT INDIVIDUAL SITES

TERRINGTON CARR

Terrington Carr (GR 44/685.715) was the most important single site in the Howardian Hills, and one of the richest locations for plants in Yorkshire. The fate of those rare species recorded there by Teesdale (1794, 1800) and Ibbotson (1843) is traced in Table 2; the species for which Terrington Carr was their only station are indicated (all available sources used). Following the wet summer of 1860 the carr was drained and then planted in part with spruce and Scots pine. In 1926 these were observed to have been recently cut down. Much of the area was then replanted. A small section of the site, west of the main carr, still exists in an unplanted condition (1988) but contains no rare plant species, suggesting that originally the cessation of grazing associated with afforestation may have been almost as important as the development of a dense tree canopy. Recently the drainage channels have been further deepened. Today other sites in the Howardian Hills are considerably

TABLE 2. THE FATE OF THOSE PLANTS OF THE HOWARDIAN HILLS (AS DEFINED IN TABLE 1) RECORDED FROM TERRINGTON CARR BY TEESDALE (1794, 1800) AND IBBOTSON (1843)

	1794–1843	1898[a]	1947[b]	1988[c]
Mire habitat				
Drosera anglica[d]	+	–	–	–
D. intermedia[e]	+	(+)	+	–
D. rotundifolia[d]	+	(+)	+	–
Galium uliginosum	+	+	+	–
Gentiana pneumonanthe[e]	+	–	–	–
Hypericum elodes	+	–	–	–
Scutellaria minor[d]	+	–	–	–
Utricularia minor[d]	+	+	–	–
Vaccinium oxycoccos	+	–	–	–
Aquatic habitats & river margins				
Berula erecta[e]	+	–	–	–
Bidens cernua[e]	+	–	–	–
Callitriche autumnalis[e]	+	+	–	–
Littorella uniflora	+	–	–	–
Ranunculus lingua[e]	+	–	–	–
Utricularia vulgaris[e]	+	–	–	–
Other habitats				
Gentianella campestris[e]	+	–	–	–
Parnassia palustris	+	+	–	–
Radiola linoides[e]	+	–	–	–
Woodlands				
Cephalanthera longifolia	+	–	–	–
Trollius europaeus	+	–	–	–
Total	20	6	3	0

+ present; (+) assumed present as recorded subsequently; – absent.

[a] *Trans. Yorks. Nat. Union* **26** and circular no. 138.

[b] Rob (1963) and *The Naturalist* (1947) p. 22.

[c] Visit by author; *Viola palustris* (a residual species) and *Hydrocotyle vulgaris* were present.

[d] Recorded only from Terrington Carr.

[e] Recorded from Terrington Carr and one other site (using all available records).

richer in wetland species (e.g. Aireyholme Marsh, GR 44/672.737, and Scackleton Low Moor by the Dalby Bush Beck, GR 44/645.715).

The post-1860 changes in the land management regime have had a drastic and almost certainly irreversible effect on the rare flora of this site, and consequently of the Howardian Hills as a whole. Parallel changes have taken place in the Huntingdonshire fenland (Sheail & Wells 1980, 1983).

MALTON FIELDS

Malton Fields was the richest site for arable species in the Howardian Hills (Table 3). Enclosure of these open fields, which happened shortly after Teesdale made his records, appears to have led to changed agricultural practices and the loss of the rare flora. Four of the ten species have not been recorded from any other site within the Howardian Hills at any time (i.e. considering all available records). Parallel development took place at Bulmer Fields and Coneysthorpe Fields (Table 3).

The publication of the *British Red Data Book* (Perring & Farrell 1983) has highlighted the rapid decline of many arable plants, and hence the need to conserve both arable species and arable habitats. Three of the plants once found at Malton Fields now qualify for entry in the *B.R.D.B.* Conversely Terrington Carr contained no *B.R.D.B.* species.

TABLE 3. THE NUMBER OF RARE PLANTS RECORDED FROM MALTON FIELDS AND TWO OTHER ARABLE LOCATIONS WITHIN THE HOWARDIAN HILLS

	Date of enclosure		Number of rare native & introduced species	Number of rare native species	Number of British Red Data Book species	Post-1943 situation	
	Act	Award				Survival at site	Survival in the Howardian Hills
Malton Fields (no 1843 records)	1794	1805	10	7	3	0	1
Bulmer Fields (no 1843 records)	1777	1779	5	4	0	0	1
Coneysthorpe Fields (no 1794 records)	—[a]	—[a]	3	3	0	0	0

[a] no documentation survives as far as is known; presumably enclosure was undertaken by private agreement.

HABITAT FACTORS

WOODLAND

The survival of the woodland flora in the region as a whole is excellent; though the number of rare species at one single wood is normally small, an average of 0·7 per wood was obtained when fourteen ancient woods were surveyed. For the six woods with at least one presence, the figure was 1·7 per wood. The high plant survival rate is partly due to the lack of destruction of this habitat, and partly due to the nature of the woodland species, many of which are able to live over long periods of sub-optimal conditions of dense shade.

Most of the woods are now heavily grazed by rabbits, a process which reduces the competitiveness of susceptible species and thereby aids the survival of rabbit-proof plants like *Actaea spicata*, *Campanula latifolia* and *Lithospermum officinale*. *Stellaria nemorum* and *Crepis paludosa* are normally found in the dampest parts of woods where levels of rabbit grazing are low. Several of the woods have a dense canopy producing a sparse shrub layer, and a poorly developed (in terms of biomass) ground flora. This combination is often the result of woods being managed mainly for pheasant rearing rather than timber production. In such densely shaded woods the less common woodland plants may often be confined to the margins, as is the case with *Euonymus europaeus* and

Gagea lutea, or occur completely in the open but adjacent to woodland as with *Trollius europaeus* and *Vicia sylvatica*.

Conversion of broad-leaved woods to conifers (as at Oxcarr and Kirkham Woods) can produce conditions disfavourable to the survival of broad-leaved plants. Even where broad-leaved woods survive conditions may not be suitable for seed production and/or establishment at the scale necessary to ensure the long term survival of the rare species.

GRASSLAND

Survival of grassland species has been moderate. Most of the unconfirmed species are either large flowered, or are orchids which tend to be noticed if present; hence all unconfirmed species are probably now extinct in the area.

AQUATIC HABITATS & RIVER MARGINS

Several of the pools beside the River Derwent are now covered with a dense tree and shrub canopy, and this has undoubtedly contributed to the decline in wetland species. Large water bodies like Wiganthorpe Lake and Castle Howard Lake have also experienced a decline in rare species, possibly due to eutrophication of the inflow water. There have also been apparent losses from banks of the River Derwent, which might seem a stable microhabitat, of *Berula erecta*, *Lysimachia vulgaris* and *Sagittaria sagittifolia*. Despite these observations the continued existence of a good range of water-bodies of a variety of sizes is likely to ensure the survival of a fair selection of wetland species.

Two aquatic plants were known to have been introduced into Castle Howard Lake by Robert Teesdale, but the original source of the material is not known. *Nymphoides peltata* still grows there (last recorded 1962); but *Stratiotes aloides* appears to have become extinct in the middle of the last century.

MIRE

Most of the mire species grew in the sites where drainage was such that an acid peat developed, dependent on rainfall for its water supply and for the nature of its leaching regime; this was particularly the case at Terrington Carr. Such habitats are easily destroyed by drainage and the subsequent oxidation of the upper peat deposits. Only three mire species survived post-1943 at Terrington Carr and none by 1988 (Table 2). No further rediscoveries seem likely.

OTHER HABITATS

This group of habitats is strongly characterised by a high overall loss of rare plants. Dry heaths and commons have disappeared due to enclosure and/or 'improvement', with the consequent loss of *Antennaria dioica*, *Empetrum nigrum*, *Mentha pulegium*, *Radiola linoides* (Coulton Moor and Terrington Carr) and *Silene otites*. *Mentha pulegium* (a plant of damp areas within heath and common) and *Silene otites* are both *B.R.D.B.* species, underlining the national significance of the decline of this type of habitat. Roadside verges have changed in nature, partly due to cessation of grazing by farm animals-on-the-move, and reduced levels of mowing, resulting in a disappearance of *Calamintha ascendens*, *Helleborus viridus* and *Nepeta cataria*. In addition quarries and sand-pits have been abandoned, causing *Ophrys apifera* and *Trifolium striatum* to become extinct in the Howardian Hills.

The results demonstrate the need, as a long term objective, for the conservation of whole blocks of the landscape in a few specially selected areas within the country as a whole, so that the full range of habitats can be sympathetically managed, all within a narrow geographical compass (e.g. at the scale of an English parish).

ARABLE

Arable habitats show the greatest loss of species. Four arable species once found in the Howardian Hills now qualify for *B.R.D.B.* status. These are the native plants *Bupleurum rotundifolium*, *Galium spurium* and *Rhinanthus angustifolius* together with the introduced *Caucalis platycarpos*. The first-named is now extinct in the British Isles (Perring & Farrell 1983).

The management changes associated with enclosure were a major factor associated with the decline of many of the arable species recorded by Teesdale. Subsequent developments have further

reduced the variety and abundance of rare arable species. These include a) more efficient seed cleaning, b) non-use of home-grown seed, c) higher levels of application of fertiliser and lime, d) planned crop rotations involving non-arable break-crops, e) use of autumn-sown cereals (with loss of spring establishment possibilities for arable weeds), and f) selective herbicide application (Fryer & Chancellor 1970). Within the hills *Bupleurum rotundifolium* and *Rhinanthus angustifolius* have become extinct as a result of better seed cleaning techniques; *Myosurus minimus* has almost certainly succumbed to more vigorous crop growth, and several species have probably been adversely affected by the use of selective herbicides (e.g. *Papaver argemone*, *Ranunculus parviflorus* and *Torilis nodosa*).

At least two of the plants recorded from arable habitats (*Acinos arvensis* and *Jasione montana*) are more commonly associated with other habitats at the national level, and demonstrate the former importance of infertile arable sites as a refugium for a wide range of native species characteristic of disturbed, light soils.

The arable habitat has suffered a major loss of rare plant species. Only the more common species still persist in this habitat, and these are normally now only found in gateways, field margins and in broad-leaved crops where the spraying regime is less disfavourable to their survival.

It is probably now too late to reinstate old-fashioned forms of agriculture at one or more selected locations within the Howardian Hills in order to conserve the associated rare arable flora. However, the fact that the arable habitat has proved so vulnerable to date does demonstrate the need for stronger conservation measures for arable plants in the future, at both a regional and national level.

DISCUSSION

Both Teesdale and Ibbotson provided site details with their records. This has allowed the records to be allocated precisely to the study region. It also allows the original site to be revisited to check on the subsequent survival of the species. Such information provides a base-line for studying botanical and ecological change. Its value cannot be overstated. For historical data it lends confidence to source data; and for modern botanical surveys it provides the foundation for future investigations.

Having the wealth of accurate plant data that have been collected from Yorkshire in the nineteenth century to draw upon, Baker (1906) was able to deduce that certain plant species were characteristic of primary woods (as defined by Peterken 1981), many decades before the more famous work on indicator species of ancient woods undertaken by Peterken (1974, 1981). Describing *Helleborus viridus*, in North Yorkshire, Baker (1906; but first published in serial form in 1889) wrote "a plant of *aboriginal* woods of calcareous dales, where it grows with *Actaea*, *Aquilegia*, *Melica nutans*, *Rubus saxatilis* etc." (p. 251). This is an important demonstration of the value of site-specific data collected from a large number of locations.

In Huntingdonshire accurate botanical information, both written and on herbarium sheets, has allowed a detailed reconstruction of the former nature of the fenlands to be undertaken by Sheail & Wells (1980, 1983).

Accurate botanical data may also be of relevance to other academic disciplines. An Ibbotson herbarium sheet at **NCE** of *Erysimum cheiranthoides* tells us that it was collected from a turnip field at Ganthorpe. Similarly *Galium spurium*, recorded by Teesdale (1794) from Malton Fields, is stated by Lees (1941) always to be associated with flax crops, allowing us to deduce that flax was being grown in this open field system. Hence it is possible to begin to build up a picture of past land-use in the landscape using botanical information.

Drawing on the data of Teesdale and Ibbotson it has been possible to demonstrate that the Howardian Hills have passed from an area that was botanically famous to one which today has very little regional significance. The quality of the data allows one to state the case with confidence; the magnitude of the change serves to indicate the way in which species and habitats can be lost, though hopefully such changes are less likely to occur in the late 20th century due to the existence of voluntary and statutory conservation bodies.

Baker (1907: see Introduction section for quotation) indicated that the Howardian Hills were second only in botanical importance in North Yorkshire to Upper Teesdale. The Howardian Hills are a lowland area which once contained a very mixed flora, including six species now qualifying for *B.R.D.B.* status, all of which have become extinct. By contrast Upper Teesdale is an upland area

with a rather specialised flora, fifteen species of which now qualify for *B.R.D.B.* status. However only one of these (*Polemonium caeruleum*) has become extinct, and this is apparently the only extinction in Upper Teesdale (Clapham 1976), compared to 73 extinctions of 'rare' and 'very rare' species in the Howardian Hills (not to mention many others not falling within this definition). The extensive nature of land-use in Upper Teesdale has ensured to a large degree the survival of its flora. It would seem logical to conclude that areas subject to more intensive land-use pressure should attract a correspondingly higher level of conservation protection for their component species and/or habitats. Although some of the extinctions in the Howardian Hills did take place in the 19th century, continuing fieldwork will almost certainly indicate a further loss in the last two decades of species that were present in the 1940s and 1950s.

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REFERENCES

ALLEN, D. E. (1986). *The botanists: A history of the Botanical Society of the British Isles through a hundred and fifty years*. Winchester.

AUDEN, G. A., ed. (1906). *Historical and scientific survey of York and district*. York and London.

BAINES, W. (1840). *Flora of Yorkshire*. Halifax.

BAKER, J. G. (1854). *Supplement to Baines' Flora of Yorkshire*. London.

BAKER, J. G. (1906). *North Yorkshire: studies of its botany, geology, climate and physical geography*, 2nd ed. London.

BAKER, J. G. (1907). Botany, in PAGE, W., ed. *Victoria county history of the county of York* **1**: 137. London.

CLAPHAM, A. R. (1976). *Upper Teesdale: The area and its natural history*. London.

CLAPHAM, A. R., TUTIN, T. G. & MOORE, D. M. (1987). *Flora of the British Isles*, 3rd ed. Cambridge.

CRACKLES, F. E. (1967). Some plant records by Robert Teesdale. *The Naturalist* No. 901: 37–47.

DONY, J. (1977). Change in the flora of Bedfordshire, England, from 1798 to 1976. *Biol. Conserv.* **11**: 307–320.

FOLEY, M. J. Y. (1987). The current distribution and abundance of *Orchis ustulata* L. in northern England. *Watsonia* **16**: 409–415.

FRYER, J. D. & CHANCELLOR, R. J. (1970). Herbicides and our changing weeds, in PERRING, F. H., ed. *The flora of a changing Britain*, pp. 105–118. Hampton, Middlesex.

GILMOUR, J. & WALTERS, M. (1972). *Wild flowers*, 2nd ed. London.

GULLIVER, R. L. (1979). Henry Ibbotson 1814–1886. *York History* **5**: 269–270.

GULLIVER, R. L. (1985). Dicotyledonous plants in the Howardian Hills, North Yorkshire, recorded in the period 1794–1843, compared with their survival since 1943, in SMITH, R. T., ed. *Biogeographical Monographs 2: The biogeographical impact of land use change: collected essays*. Leeds.

HASLAM, S., SINKER, C. & WOLSELEY, P. (1975). British water plants. *Field Studies* **4**: 243–251.

IBBOTSON, H. (1843). Rarer plants found near Castle Howard, Yorkshire. *Phytologist* **1**: 577–579.

IBBOTSON, H. (1844). List of mosses found near Castle Howard, Yorkshire. *Phytologist* **1**: 781–782.

LEES, F. A. (1941). *A supplement to the Yorkshire floras*. Hull.

MARGETTS, L. J. & DAVID, R. W. (1981). *A review of the Cornish flora 1980*. Redruth.

NOLTIE, H. J. ed. (1986). *The long tradition: the botanical exploration of the British Isles*. Kilbarchan, Renfrewshire.

PERRING, F. H. & FARRELL, L. (1983). *British red data books: 1 vascular plants*, 2nd ed. Lincoln.

PERRING, F. H. & WALTERS, S. M., eds. (1962). *Atlas of the British flora*. London.

PERRING, F. H. & SELL, P. D. (1968). *Critical supplement to the atlas of the British flora*. London.

PETERKEN, G. F. (1974). A method for assessing woodland flora for conservation using indicator species. *Biol. Cons.* **6**: 239–245.

PETERKEN, G. F. (1981). *Woodland conservation and management*. London.

ROB, C. M. (1963). An introduction to *A catalogue of the more rare wild plants of the Castle Howard district*, by R. Teesdale; the republished list and comments on the present status of the species. *Ann. Rep. Council Yorks. Phil. Soc. 1962*. York.

SHEAIL, J. & WELLS, T. C. E. (1980). The Marchioness of Huntly: the written record and the herbarium. *Biol. J. Linn. Soc.* **13**: 315–330.

Sheail, J. & Wells, T. C. E. (1983). The fenlands of Huntingdonshire, England: a case study in catastrophic change, in Gore, A. J. P., ed. *Mires: Swamp, Bog, Fen and Moor*. Vol. B, pp. 375–393. Amsterdam.
Teesdale, R. (1794). *Plantae Eboracenses. Trans. Linn. Soc.* **2**: 103–125.
Teesdale, R. (1800). A supplement to the *Plantae Eboracenses. Trans. Linn. Soc.* **5**: 86–95.
Trist, P. J. O. (1979). *An ecological flora of Breckland*. East Ardsley.
Warburton, S., ed. (1978). *The Yorkshire Derwent: a case for conservation*. York.
Webb, D. A. & Scannell, M. J. P. (1983). *Flora of Connemara and the Burren*. Cambridge.

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APPENDIX I

DESCRIPTION OF SOURCES USED TO ASSESS THE POST-1843 STATUS OF THE RARE PLANTS OF THE HOWARDIAN HILLS.

Manuscript sources consulted include the card-index of plants in v.c. 62 held by the vice-county recorder, the field notebooks of T. F. Medd Esq., entries in the diaries of Wild Flower Society members submitted to the vice-county recorder, record cards completed during the B.S.B.I. Atlas survey and B.S.B.I. visit notes, reports of meetings of the York & District Field Naturalists' Society.

Herbaria consulted include W. W. Reeves at **SCAR**, H. J. Wilkinson and W. Middleton at **YRK**, general at **WARMS**, all with Ibbotson sheets, and computer print-outs of Ibbotson sheet details at **NCE**; plus C. M. Rob's at **YRK**. Journals consulted include all relevant issues of *The Naturalist*, together with the advance notices of Yorkshire Naturalists Union excursions giving details of local flora and fauna, i.e. the circulars; *Nature Notes*, the journal of the Malton and District Field Naturalists' Society, the *Natural History Journal and School Reporter*, plus Rob (1963) and Crackles (1967).

Books consulted include Auden (1906) and Warburton (1978); floras consulted include Baines (1840: for pre-1843 sites), Baker (1854), Baker (1906), and Lees (1941). Personal communications were received from Professor S. R. Eyre, Mrs A. Freer, Miss J. Lambert, Mr T. Medd and others.

APPENDIX 2. PLANTS OF THE HOWARDIAN HILLS CONSIDERED RARE BY TEESDALE (1794 & 1800) AND IBBOTSON (1843) WHICH OCCUR IN THIRTY OR FEWER 10-KM SQUARES POST-1930 (PERRING & WALTERS 1962; PERRING & SELL 1968), IN THE 100-KM SQUARE 4/4: ARRANGED BY HABITAT AND POST-1943 STATUS. POSITION AS AT JUNE 1988.

	Woodland	Aquatic habitats & river margins[a]	Mire	Grassland	Arable	Other habitats
CONFIRMED						
Regionally rare[b]	*Convallaria majalis* *Crepis paludosa* *Daphne laureola* *Euonymus europaeus* *Lathraea squamaria* *Paris quadrifolia* *Stellaria nemorum*	*Hippurus vulgaris* *Myriophyllum spicatum* *Potamogeton pusillus* *Stellaria palustris*	*Drosera rotundifolia* *Galium uliginosum*	*Anacamptis pyramidalis* *Cirsium eriophorum* *Coeloglossum viride* *Filipendula vulgaris* *Gymnadenia conopsea* *Saxifraga granulata*	*Erysimum cheiranthoides* *Silene noctiflora* *Scleranthus annuus*	*Cynoglossum officinale* *Geranium pyrenaicum* *Prunus padus* Introduced *Inula helenium* *Sedum dasyphyllum*
Regionally very rare[c]	*Actaea spicata* *Gagea lutea* *Platanthera bifolia* *Pyrola minor* *Trollius europaeus* *Vicia sylvatica*	*Littorella uniflora* *Nymphoides peltata* *Potamogeton gramineus* *Ranunculus lingua* *Rorippa amphibia*	*Drosera intermedia*	*Colchicum autumnale* *Ornithogalum umbellatum*		*Helleborus viridis* *Orobanche elatior* *Rosa pimpinellifolia*
UNCONFIRMED: ASSUMED EXTINCT						
Regionally rare[b]	*Aquilegia vulgaris* *Frangula alnus*	*Berula erecta* *Hottonia palustris* *Oenanthe aquatica* *Sagittaria officinalis* *Zannichellia palustris*	*Vaccinium oxycoccos*	*Ophrys apifera* *Orchis morio* *Parnassia palustris* *Serratula tinctoria* *Thalictrum flavum*	*Acinos arvensis* *Papaver agremone* *Valerianella dentata* *Veronica polita* Introduced *Allium oleraceum*	*Atropa belladonna* *Dactylorhiza incarnata* *Empetrumnigrum* Introduced *Allium scorodoprasum*

APPENDIX 2 *continued*

	Woodland	Aquatic habitats & river margins[a]	Mire	Grassland	Arable	Other habitats
Regionally very rare[c]	*Cephalanthera longifolia* *Hypericum montanum* *Neottia nidus-avis* *Rubus saxatilis*	*Bidens cernua* *Butomus umbellatus* *Callitriche hermaphroditica* *Lemna polyrhiza* *Myriophyllum verticillatum* *Potamogeton compressus* *Rorippa islandica* *Sium latifolium* *Stratiotes aloides* *Utricularia vulgaris*	*Drosera anglica* *Gentiana pneumonanthe* *Hypericum elodes* *Scutellaria minor* *Utricularia minor*	*Dianthus deltoides* *Ophrys insectifera* *Orchis ustulata* *Spiranthes spiralis*	*Bupleurum rotundifolium*[de] *Fumaria capreolata* *Galium spurium*[d] *Iberis amara* *Jasione montana* *Legousia hybrida* *Minuartia hybrida* *Myosurus minimus* *Papaver hybridum* *Ranunculus parviflorus* *Rhinanthus angustifolius*[d] *Torilis nodosa* Introduced *Caucalis platycarpos*[df] *Galeopsis ladanum* *Lathyrus aphaca* *Malva alcea*	*Antennaria dioica* *Astragalus danicus* *Calamintha ascendens* *Circaea* × *intermedia*[g] *Gentianella campestris* *Geranium sanguineum* *Linum perenne* *Listera cordata* *Lythrum portula* *Mentha pulegium*[d] *Nepeta cataria* *Picris hieracioides* *Potentilla argentea* *Potentilla tabernaemontani* *Radiola linoides* *Rosa mollis* *Silene otites*[d] *Trifolium striatum* *Verbena officinalis* Introduced *Chamaemelum nobile*

Footnotes:
[a] category based largely on Haslam, Sinker & Wolseley (1976)
[b] present in 16–30 10-km squares in 100-km square 4/4
[c] present in 0–15 10-km squares in 100-km square 4/4
[d] included in the *British Red Data Book* (Perring & Farrell 1983)
[e] now extinct in the British Isles (Perring & Farrell 1983)
[f] see Teesdale (1800) which supersedes Teesdale (1794)
[g] recorded as *C. alpina*; now considered to be *C.* × *intermedia* (Perring & Sell 1968)

Short Notes

MICROMORPHY IN NEW FOREST *RUBI*

True-breeding miniature variants ('micromorphs') are known in a number of the microspecies of *Rubus fruticosus* L. agg. and in certain cases these are sufficiently widespread to have been accorded taxonomic recognition, usually at varietal level. They are especially characteristic of scrubby heathland, to which they are presumably an ecotypic adaptation.

It has emerged from recent fieldwork that there is an exceptional concentration of these variants on the western edge of the New Forest (S.Hants., v.c. 11). *R. pyramidalis* Kaltenb. occurs in that area (chiefly, scattered over the Linford district, east of Ringwood) exclusively as its var. *parvifolius* Frid. & Gelert. The analogous variant of *R. nemoralis* Mueller (var. *microphyllus* (Lindeb.) W. C. R. Watson; *R. pistoris* Barton & Riddelsd.), which is seemingly confined to the New Forest as far as the southern half of England is concerned, rises from scarcity in the Forest more generally to become common in the north-western corner, virtually to the exclusion of var. *nemoralis*. Also in the north-western corner, in one place, a micromorph has been found of – very probably – *R. imbricatus* Hort (the solitary bush is unfortunately too stunted for certainty). Further south, patches of a diminutive version of the Pennine species *R. furnarius* Barton & Riddelsd. occur in three widely separated localities focussed on Burley. Finally, a micromorph of *R. errabundus* W. C. R. Watson which is thinly distributed throughout the Forest becomes particularly plentiful in the north-western corner and further south on Rockford and Little Castle Commons.

Recent palynological work (Barber 1975, 1981; Clarke & Barber 1987) has established that the central part of the Forest, at least that area round Mark Ash, has had a continuous woodland cover throughout the last 10,000 years. The history of the peripheral areas is less susceptible to that approach, but the near-absence there of Neolithic finds and the abundance of Bronze Age ones are sufficient to indicate a significant amount of clearance in the latter period. Subsequent avoidance of these areas in the Iron Age is attributed to soil deterioration causing the abandonment of pastures and extensive reversion to heathland. Only persistent grazing, browsing and burning can have prevented this heathland from reverting to woodland in its turn (Tubbs 1968; Barber in litt. 1989).

The restriction of the high incidence of *Rubus* micromorphy, which is indicative of intense selection pressure, just to the Forest's western periphery would seem to suggest that some special factor or factors, anthropogenic or otherwise, conducive to the persistence of low thorny scrub have operated there from which the other peripheral areas have been relatively free. Whatever the explanation for the anomaly, it is one that historical ecologists need to take into account.

REFERENCES

Barber, K. E. (1975). Vegetational history of the New Forest: a preliminary note. *Proc. Hampshire Field Club* **30**: 5–8.

Barber, K. E. (1981). Pollen-analytical palaeoecology in Hampshire: problems and potential, in Shennan, S. J. & Schadla-Hall, R. T., eds. *The archaeology of Hampshire*, pp. 91–94. Winchester.

Clarke, M. J. & Barber, K. E. (1987). Mire development from the Devensian Lateglacial to present at Church Moor, Hampshire, in Barber, K. E., ed. *Wessex and the Isle of Wight: field guide*, pp. 23–32. Cambridge.

Tubbs, C. R. (1968). *The New Forest: an ecological history*. Newton Abbot.

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YELLOW IVY BROOMRAPE

In 1979 Mrs A. A. Butcher found apparent *Orobanche hederae* Duby growing abundantly on ivy at The Police House, Alresford, N. Hants., v.c. 12, only it was bright yellow. Unfortunately the whole

colony, with its ivy, was completely destroyed the next year; but this year Mr F. J. Rumsey has identified it from a pressed specimen as indeed *O. hederae*. The ivy was identified by Dr H. A. McAllister as *Hedera hibernica* (Kirchner) Bean cultivar Hibernica (Irish Ivy).

In 1988 I realised that the same plant had been growing for years in two of the canons' gardens at Winchester, v.c. 11, also on Irish Ivy. A visit to the British Museum taught me that this yellow variant should be referred to forma *monochroma* G. Beck, not yet recorded from Britain. It is simply an albino.

This year, 1989, Mrs Butcher found a fresh, small colony in Alresford, not far from the old one, and again on *H. hibernica* cv. Hibernica.

Possibly emanating from trouser turn-ups, a single spike appeared in the garden of Dr F. Rose in Liss, v.c. 12, shortly after the Alresford police garden find, but never again. All the ivy in this garden is *H. helix* L.

Alresford and Winchester are only about 16 km apart. The interesting question is: did the *H. hibernica* originally come from the same nursery and bring with it the yellow Ivy Broomrape?

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A NEW COMBINATION IN *COCHLEARIA* (CRUCIFERAE)

In the forthcoming identification manual for the British and Irish Cruciferae, edited by T. C. G. Rich, I use the name *Cochlearia pyrenaica* DC. to include those plants usually placed in *C. officinalis* L. subsp. *alpina* (Babington) Hooker. This necessitates the following new combination:

Cochlearia pyrenaica DC. subsp. **alpina** (Babington) Dalby, **comb. nov.**
C. officinalis L. β *alpina* Babington, *Man. Brit. bot.* 27 (1843).

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CHROMOSOME NUMBERS IN TWO *LIMONIUM* SPECIES

Limonium vulgare Mill. and *L. humile* Mill. (Plumbaginaceae) are found in salt marshes around the coast of Britain, sometimes growing together in the same marsh. Both have different breeding systems, *L. vulgare* being dimorphic (for pollen and stigma) and self-incompatible, while *L. humile* is monomorphic and self-compatible. This pollen/stigma dimorphism is present throughout the Plumbaginaceae and, in *Limonium*, the two pollen morphs differ by having either a coarsely reticulate exine (A type) or a finely reticulate exine (B type). The stigma morphs differ in cell shape, the so-called 'cob' stigma having the appearance of a corn cob, while the papillate ('pap') stigma possesses cells with protuberant papillae. Plants of *L. vulgare* have either an ACob or BPap morph combination, while monomorphic *L. humile* plants have a morph combination of APap. Previous chromosome counts show that *L. vulgare* is a tetraploid with 2n=36 (Wulff 1937; Baker 1953; Rodrigues 1953). *L. humile*, from Blakeney Point, was counted as 2n = 36 by Choudhuri (1942) but this was based on only one count from one plant. Erben (1979), using European material, recorded a mitotic count of 2n = 54, indicating that *L. humile* is a hexaploid.

Mitotic counts were made using root tips from live material collected from marshes throughout the range of *L. humile* in a bid to investigate this discrepancy. Counts of *L. vulgare* were also made and all the results are given in Table 1. Scottish and Irish material of *L. humile* was found to be hexaploid (2n = 54) along with plants from sites in western Wales (Dale and Monkton, Dyfed). At

TABLE 1. MITOTIC CHROMOSOME COUNTS IN POPULATIONS OF *LIMONIUM HUMILE* AND *L. VULGARE*

Counts on the same line are from the same plant, but counts on different lines are from different plants. Figures in brackets give number of cells with that particular chromosome number.

Species & Locality	Grid reference	2n
L. humile		
W. Sussex, v.c. 13, Chidham	41/795.043	*36(5), 38(2)
W. Sussex, v.c. 13, Itchenor	41/785.010	*49(1), 54(2)
Pembs., v.c. 45, Dale	12/813.072	48(1)
		50(6)
		51(1)
		52(1)
		54(1)
		54(4)
		54(3)
Pembs., v.c. 45, Monkton	12/971.018	54(4)
Kirkcudbrights., v.c. 73, Creetown	25/472.585	54(1)
Kirkcudbrights., v.c. 73, Ross Bay	25/647.447	54(6)
S. Kerry, v.c. H1, Dromore Woods	00/792.673	54(2)
S. Kerry, v.c. H1, Cromane	00/70.97	54(3)
Co. Clare, v.c. H9, Killadysert	11/280.600	54(1)
L. vulgare		
W. Sussex, v.c. 13, Itchenor	41/785.010	36(3)
		36(1)
		36(2)
		*36(1)
		36(1)
		*36(1)
Glam., v.c. 41, Crymlyn	21/724.933	36(3)

* plants intermediate in morphology between *L. vulgare* and *L. humile*.

Itchenor, W. Sussex, with populations of both *L. humile* and *L. vulgare*, an intermediate APap plant was recorded as having counts ranging from 2n = 49 to two counts of 2n = 54. At Chidham, W. Sussex, an APap plant was recorded as a tetraploid (2n = 36, five counts) with two counts of 2n = 38. This plant, intermediate in morphology, is possibly a backcrossed hybrid. All *L. vulgare* plants from Itchenor have tetraploid counts (2n = 36) as does a plant from Crymlyn, W. Glamorgan.

Certain morphological variants, intermediate between the two species, can be found at sites where both species grow together and these have been reported as hybrids (Salmon 1904; Ockendon 1978). Because of the high morphological variability of *L. vulgare* and the fairly high pollen stainabilities (60–79%) of some intermediates, it was thought that they may simply be morphological variants of *L. vulgare*. Mainly due to the lack of material, the results from the chromosome counts appear inconclusive about this matter. Two intermediate plants from Itchenor, with a *L. vulgare* morph combination (ACob), are indeed *L. vulgare* with counts of 2n = 36.

Variation in chromosome number recorded at some sites may be due to several reasons connected with the specimen preparation procedure. Chromosome fragmentation may have occurred as a result of excessive pressure applied during squashing. This may also have led to cell wall rupture leading to the mixing of the contents of two adjacent cells. The relatively small size of some of the smaller chromosomes may account for some of the low counts as one or more chromosomes may be obscured by a larger one.

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REFERENCES

BAKER, H. G. (1953). Dimorphism and monomorphism in the Plumbaginaceae, III. Correlation of geographical distribution patterns with dimorphism and monomorphism in *Limonium*. *Ann. Bot.* **17**: 615–627.

CHOUDHURI, H. C. (1942). Chromosome studies in some British species of *Limonium*. *Ann. Bot.* **6**: 183–217.

ERBEN, M. (1979). Karyotype differentiation and its consequences in Mediterranean *Limonium*. *Webbia* **34**: 409–417.

OCKENDON, D. J. (1978). *Limonium* Miller. in STACE, C. A., ed. *Hybridization and the flora of the British Isles*, p. 344. London.

RODRIGUES, J. E. DE (1953). Dissertation. University of Coimbra.

SALMON, C. E. (1904). Notes on *Limonium* II: *L. Neumani* (*L. humile* × *L. vulgare*). *J. Bot., Lond.* **42**: 361–363.

WULFF, H. D. (1937). Karyologische Untersuchungen an der Halophytenflora Schleswig-Holsteins. *Jb. Wiss. Bot.* **84**: 812–840.

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WILD FIGS BY THE RIVER DON, SHEFFIELD

For a long time the wild figs (*Ficus carica* L.) by the river Don have gone almost unnoticed. Though they are mentioned in surveys of the river (Shaw 1979, 1981) it has taken till now for local botanists to realise that to find fig trees in large numbers is very unusual in Britain. A perusal of county floras has shown that only by the river Avon where it flows through Bristol and by the Thames in London is the phenomenon repeated. In summer 1987, as part of a survey of the industrial Don sponsored by the Nature Conservancy Council, this riverside population of figs was studied.

During the course of preparing vegetation maps of the banks, 35 fig trees were encountered along this 16 km stretch of urban river. From the middle of Sheffield they occur regularly but sparsely up to the Rotherham boundary. In one place they form a tiny wood. Most are rooted in or at the base of retaining walls, one is present on a small island and a few at the eastern end of the survey area are on an earth bank. All are growing under moist, eutrophic conditions, their chief associates being shade-tolerant species typical of river margins, such as *Alliaria petiolata*, *Impatiens glandulifera*, *Ranunculus ficaria*, *Anthriscus sylvestris* and *Poa trivialis*. This is a very different community from that occurring on the dry, rocky hillsides of the Mediterranean which is their native habitat.

All the trees are well-grown specimens with numerous stems so they appear like globular shrubs up to 8 m high and rather more across. In the Mediterranean they have a stout, single trunk. One result of this growth form is that trees at the base of river walls are efficient at trapping flood debris and silt, so small shoals build up around them. Decumbent lower branches then root in this silt so that uncertainty may arise as to how many trees make up the clump. This can usually be settled by observing leaf shape, size, texture and colour which differ considerably from tree to tree. It is unusual for trees in Britain to spread vegetatively from branches taking root.

The phenology of the figs during the 1987 season was as follows. Leaf expansion occurred during the last few days of May with certain buds opening to reveal small, hard, pear-shaped, green figs. These swelled and grew softer until mid-July when many fell off. In early September a second crop of green figs was produced which also swelled, softened and fell off by mid-October when the leaves were shed. The 'fruits' never opened and could not have been pollinated in any case as the necessary fig wasp does not occur in Britain. Most fig cultivars, however, can ripen their fruits in the absence of fertilisation. Those observed aborted before they were fully ripe. The canopy was retained for 152 days, which compares with 159 for ash, 194 for oak and 212 for beech.

The trees have proved difficult to age. Coring showed close, well marked growth-rings but, on counting, these gave ages of 100–130 years, despite not being taken from the very base. A problem is that these ages are sometimes greater than those of the retaining walls on which the specimens are growing. During 1987 the trees showed more than one flush of leaf expansion so it seems likely that in these fig trees growth rings do not correspond to annual rings. The multiple stems with no clear leader make even crude estimates of comparative age from girth measurements difficult. By observing extension growth as indicated by girdle scars it is thought that most of the figs will be at least 60–70 years old.

The origin of the figs is known – seeds derived from sewage. During rainy periods combined storm and foul water sewers become overloaded and raw sewage enters the river as it has done for hundreds of years. I have found that seeds from both dried and fresh figs bought in Sheffield germinate readily and, if further proof is needed, when testing the seed bank in 1 kg of silt collected from by the river, 15 tomato, six strawberry, one citrus and one fig plant grew. All are known to be sewage plants, the seeds of which survive a passage through the human gut. Pear (*Pyrus communis*) and apple (*Malus domestica*) on islands and shoals in the river probably have a similar provenance. In the light of these findings alternative suggestions that the figs have been planted or originated from prunings tipped into the river higher upstream (cuttings root readily) seem less likely. The genotypic variability of the local trees also mitigates against such a derivation.

Why figs should have established in such numbers by the river Don is enigmatical. Sewage enters most of our larger rivers and the consumption of figs is not restricted to Sheffield. Field evidence points to a possible explanation. The trees only occur at the eastern end of the city, yet sewage is deposited along the river throughout its length. This suggests a possible connection with heavy industry. The other significant factor is that no young fig trees were encountered, so it appears that conditions are no longer suitable for their establishment. These two observations, coupled with the Mediterranean distribution of the species, has led me to postulate that the period when the figs established coincided with the height of the steel industry. At that time river water was used for cooling purposes and the Don ran at a constant 20°C (the maximum permitted temperature); it was this special microclimate that enabled the trees to establish in such numbers. Following the decline of the steel industry, river temperatures have returned to normal, but the mature trees are able to survive.

It has recently been brought to my attention by B.S.B.I. members that naturalised fig trees also occur in the vicinity of a power station on the river Aire below Leeds and in the dead-end section of a canal in Liverpool which was once heated by discharges from Tate & Lyle's sugar refinery.

REFERENCES

Shaw, M. R. (1979). The vegetation of the industrial Don, part 5. *Sorby Record* **17**: 30–33.
Shaw, M. R. (1981). The vegetation of the industrial Don, part 6. *Sorby Record* **19**: 30–33.

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CREPIS PRAEMORSA (L.) TAUSCH, NEW TO WESTERN EUROPE

In July 1988, while attempting to refind *Crepis mollis* in northern Westmorland (v.c. 69), I came across a small fruiting colony of an unfamiliar *Crepis* growing on a low bank at the edge of a hayfield. A single stem and a basal leaf were collected and pressed (**LANC**, Fig. 1). It was soon evident that the material did not agree with any British species and recourse to *Flora Europaea* (Sell 1976) soon indicated that it was probably *C. praemorsa* (L.) Tausch subsp. *praemorsa*, and this was confirmed by examination of material at **BM** and **MANCH**.

Crepis praemorsa is a wide-ranging Eurasiatic species which extends from Manchuria to south-eastern Norway, eastern Denmark, easternmost France and northern Italy. Its discovery in Westmorland is therefore of considerable interest, being not only the first British record but also the first in western Europe. The specimen was subsequently shown at the Glasgow and London B.S.B.I. Exhibition Meetings in November 1988.

The most striking features of this species, clearly evident in Fig. 1, are the long, obovate and minutely apiculate rosette leaves, the very long and slender scape, to 65 cm, and the numerous small capitula. The two rows of involucral bracts are unusual in the genus in being eglandular and virtually glabrous. The pappus is white but the strongly ribbed, slender achenes were all abortive in the Westmorland material. This is perhaps not so surprising in view of the extreme isolation of this population.

When the site was visited in 1989 in late June the population consisted of ten plants, most of which

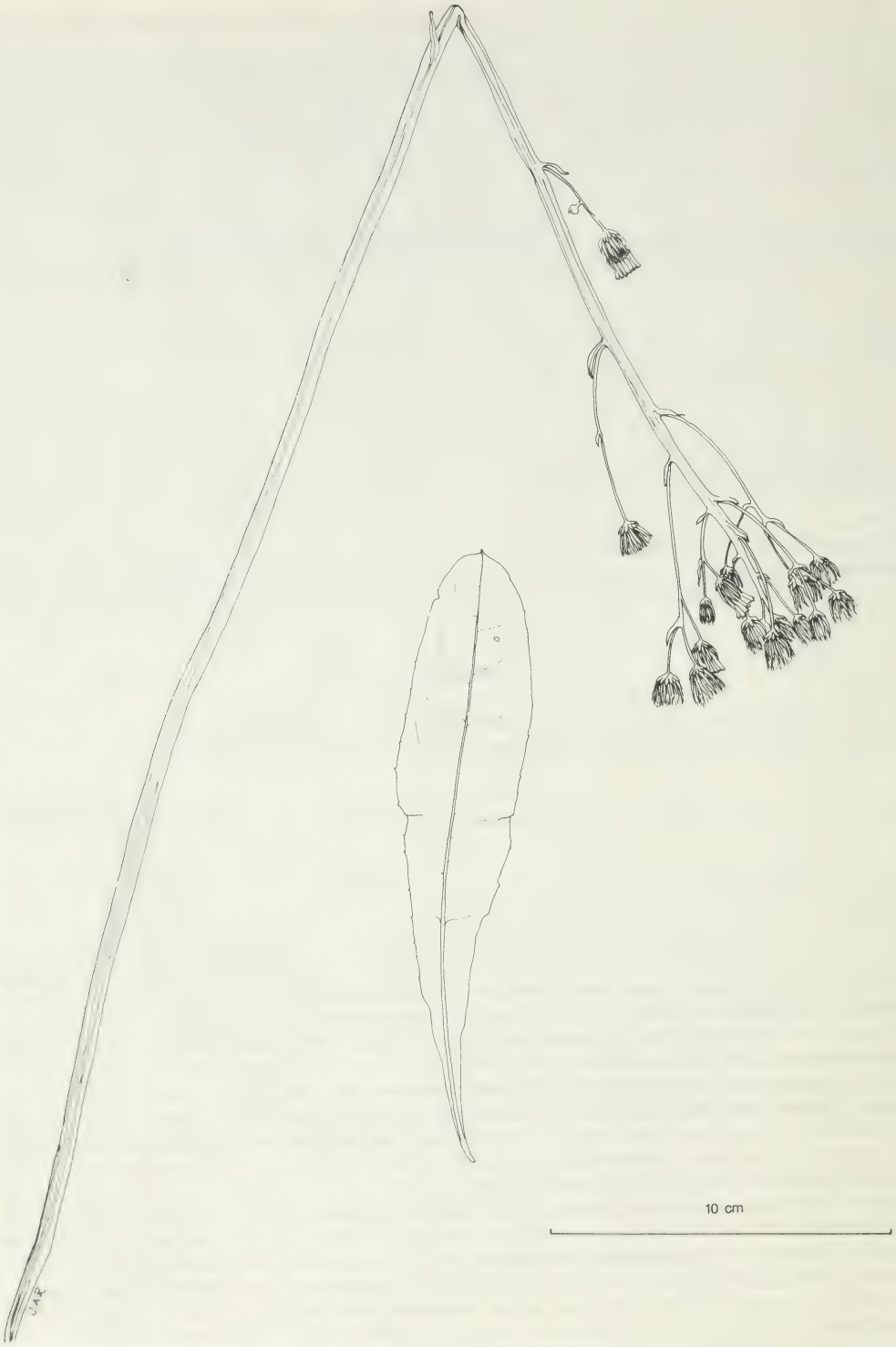

FIGURE 1. Herbarium specimen of *Crepis praemorsa* from Westmorland.

had finished flowering. However, a careful search further along the bank and in an adjacent field revealed about 150 small rosettes which probably belong to this species. The following associates were noted within 1 m of the fruiting plants:

Alchemilla vestita, *Anthoxanthum odoratum*, *Avenula pubescens*, *Briza media*, *Carex flacca*, *Centaurea nigra*, *Cynosurus cristatus*, *Dactylis glomerata*, *Festuca ovina*, *F. rubra*, *Geranium sanguineum*, *Holcus lanatus*, *Koeleria macrantha*, *Leontodon hispidus*, *Leucanthemum vulgare*, *Lotus corniculatus*, *Pimpinella saxifraga*, *Plantago lanceolata*, *Poa pratensis*, *Potentilla erecta*, *Ranunculus bulbosus*, *Sanguisorba officinalis*, *Scabiosa columbaria*, *Stachys officinalis*, *Trifolium pratense*, *Urtica dioica*.

The grassland is only lightly grazed and the dominant species in this small area were *Centaurea nigra*, *Festuca rubra* and *Plantago lanceolata*. The soil is limestone drift, pH 6.6. There is nothing particularly distinctive about this vegetation although a short, damper and more open turf a metre or two away supported *Carex ornithopoda*, *Gymnadenia conopsea*, *Pinguicula vulgaris* and *Primula farinosa*. *C. praemorsa* apparently occurs in rather similar sites on the Continent – rather dry banks and field margins, although in central Europe it is also found by the margins of submontane woodland.

One's natural instinct when confronted with such an isolated occurrence is to suspect introduction but this seems highly unlikely. The site is a piece of unimproved grassland in a remote corner of the county and within a short distance of relict occurrences of such rarities as *Bartsia alpina*, *Carex capillaris*, *Epipactis palustris* and *Polygala amara*.

ACKNOWLEDGMENT

I am indebted to Ms J. A. Rushton for the illustration.

REFERENCE

SELL, P. D. (1976). *Crepis* L., in TUTIN, T. G. *et al.*, eds. *Flora Europaea* **4**: 344–357. Cambridge.

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THE FIRST RECORD FOR *VACCINIUM ULIGINOSUM* L. VAR. *PUBESCENS* (WORMSK.) HORNEM. FROM THE BRITISH ISLES

Vaccinium uliginosum L. var. *pubescens* (Wormsk.) Hornem. differs from the typical variety in that the leaves are puberulent beneath. It was not recorded from the British Isles until Blake (1915) drew attention to two collections of it in **BM**. The earlier of these is from the herbarium of J. Sowerby. The sheet contains several sprigs, only one of which has been determined as var. *pubescens* Lange by Blake (J. M. Mullin, pers. comm.), and "is without data of any sort" (Blake 1915). The Sowerby collection is marked as having served as the original for plate 581 in *English Botany* (Smith & Sowerby 1799; Blake 1915). The second collection in **BM** was made by E. S. Marshall, near Kingshouse, Argyll, on 27 June 1888.

Blake (1913, 1915) attributed the epithet *pubescens* to Lange but this is incorrect, and the relevant synonymy is set out below.

Vaccinium uliginosum L. var. **pubescens** (Wormskjold) Hornemann, *Nomenclatura Florae danicae* Hafnia (Copenhagen) 73 (1827). *V. pubescens* Wormskjold, in *Flora Danica* **9** (26): 4, t.1516 (1816). *V. uliginosum* var. *pubescens* Lange in *Consp. fl. Groenl. Medd. Gronl.* **3**: 90 (1880), nom. superfl.

The variety was described from Greenland; it is commoner there and in North America than it is in Europe. Further work is required to establish whether this plant deserves to be recognized as a distinct variety; it may be better treated as a forma (N. K. B. Robson, pers. comm.).

Despite the lack of information on Sowerby's herbarium sheet, it has been possible to identify the locality from which his material originated. Smith & Sowerby (1799) say of *V. uliginosum* in *English Botany* "It has hitherto been observed only in Westmorland and Cumberland except the highlands of Scotland. We rec'd. wild specimens from The Rev. Mr Harriman and Mr Oliver whose favours we have had occasion to so often acknowledge". Research by the author on the botanical exploration and floristic recognition of Upper Teesdale (in prep.) demonstrates that John Harriman and William Oliver sent Smith and Sowerby plants for *English Botany* from Upper Teesdale. Oliver sent Sowerby specimens of *V. uliginosum* in flower in 1798 (see Note 1). As far as the exact locality is concerned, Backhouse Jnr (1844), referring to a meeting between Backhouse Snr and Oliver in 1811 (see Note 2), indicated that the site was near a farm-house called Moor Riggs: "In a moist meadow near a cottage on the top of a neighbouring hill, we rediscovered *Vaccinium uliginosum* which had been *gathered* (my italics) there 30 years previously, by the late Dr Oliver and James Backhouse (Snr): it is confined to very small space, and we could see no traces of either flowers or fruit." This locality is confirmed by N. Winch, who wrote in his own copy of *The botanist's guide through the counties of Northumberland and Durham* (Winch *et al.* 1805) (in the library of the Linnean Society of London), "In bogs at Moor Riggs near Middleton Teesdale. D. J.B." "J.B." is James Backhouse Snr. Backhouse Jnr (1884) later stated that a lead-miner, John Binks, discovered the species in Upper Teesdale.

Another collection of *V. uliginosum*, probably from the same locality, was gathered by S. Hailstone at "Walkers Hill, Moor Riggs, Durham" in 1824 (**YRK**). The latest Ordnance Survey map (1:25000) shows Walker Hill Plantation just north-west of East Moor Riggs Farm. *V. uliginosum* has not been seen at this site by any living botanist (W. A. Sledge, pers. comm.).

ACKNOWLEDGMENTS

I should like to thank Norman Robson and Richard Gornall for their help in preparing this note. My thanks are also due to Ron Cleevely of the British Museum (Natural History) for copies of Harriman letters in the Sowerby Correspondence, and Gina Douglas, Librarian and Archivist of the Linnean Society of London, for access to the Winch Correspondence and manuscripts. I am grateful to Mike Mullin for examining the sheet of *V. uliginosum* at **BM** for me, and to Arthur Sledge for the great encouragement he has given me in my current historical work on Upper Teesdale.

NOTES

1. Letter from John Harriman to James Sowerby dated 4 June 1799 in Sowerby Correspondence in the General Library, British Museum (Natural History).
2. Letter from James Backhouse Snr to Nathaniel Winch dated 25 July 1811 in Winch Correspondence at The Linnean Society of London.

REFERENCES

Backhouse, J. Jnr (1844). Notes of a botanical ramble in Yorkshire, etc. in the summer of 1844. *Phytol.* **1**: 1069.
Backhouse, J. Jnr (1884). Teesdale botany: historical and personal recollections. *Naturalist Hull* **10**: 10–13.
Blake, S. F. (1913). *Rhodora* **15**: 201.
Blake, S. F. (1915). Short notes. *Vaccinium uliginosum* var. *pubescens*. *J. Bot., Lond.* **53**: 90–91.
Smith, J. E. & Sowerby, J. (1799). *English Botany* **8**: t. 581. London.
Winch, N. J., Thornhill, J. & Waugh, R. (1805). *The botanist's guide through the counties of Northumberland and Durham* **1**. Newcastle-upon-Tyne.

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THE SHASTA DAISY

The Shasta Daisy was introduced into cultivation in British gardens early in the nineteenth century and has been known as a naturalized or established escape for well over half a century. Although referred to *Chrysanthemum maximum* Ramond, most 'wild' British material differs considerably from native Pyrenean plants by being taller (1–1·5 m), and more robust with thickish, coarsely serrate, oblanceolate leaves up to 30 cm long, and capitula up to 10 cm or more in diameter. *C. maximum* is shorter in stature (up to 1 m) and less robust, with thinner, entire to dentate, oblanceolate basal leaves up to 30 cm long, and capitula 6–8 cm in diameter.

Bergmans (1939) and Ingram (1975) considered the cultivated plant to be a hortal hybrid between *Leucanthemum lacustre* (Brot.) Samp. and *L. maximum* (Ramond) DC., with which I agree. I have seen material of the hybrid from v.cc. 1, 9, 11, 17, 21, 23, 28, 59 and S, and, although *L. maximum* appears to be rarely cultivated, I have seen a gathering from v.c. 59.

Leucanthemum × **superbum** (Bergmans ex J. Ingram) Kent, **comb. nov.**
Chrysanthemum × *superbum* Bergmans, *Vaste Planten en Rotsheesters*, 2nd ed., 218 (1939), *nom. nud.*; Bergmans ex J. Ingram in *Baileya* **19**: 167 (1975).
Leucanthemum lacustre (Brot.) Samp. × *L. maximum* (Ramond) DC.
Chrysanthemum maximum hort., non Ramond in *Bull. Soc. Philomatique de Paris* **2**: 140 (1800).
Leucanthemum maximum hort., non (Ramond) DC., *Prodr.* **6**: 46 (1838).

REFERENCES

BERGMANS, J. (1939). *Vaste Planten en Rotsheesters*, 2nd ed., p. 218.
INGRAM, J. (1975). Nomenclatural notes for *Hortus Third*: Compositae. *Baileya* **19**: 167–168.

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RUBUS STENOPETALUS LEF. & MUELL. IN BRITAIN

The sole British specimen available determined as *R. stenopetalus* by Watson (Everleigh Ashes, v.c. 8, 7.7.1949, *W. Watson*, **SLBI**) was compared with material from the locus classicus (*Bat. Eur.* 342, Bois de Tillet, pres Vaumoise, Valois, 1860, *Questier*, **MANCH**) by E. S. Edees and myself in 1974 and 1976. Our opinion was that while the two exhibited some similarities, their identity was not conclusively shown, especially in view of the statement by Grose (1957) that the gathering represented the sole British occurrence.

On a visit to Wiltshire in 1986 I collected a distinctive bramble, which I was unable to name, at two localities; more recently D. E. Allen has compared specimens collected by himself in several Hants. localities, some previously determined as *R. hylophilus* Rip. ex Genev., with collections of W.L.W. Eyre in the 1900s mostly named *R. thyrsoideus* by W. M. Rogers, and has suggested that these are a good match for another sheet of *Bat. Eur.* 342 in **BM**.

Now that a good range of specimens from different habitats is available, it is clear that the British and French plants belong to the same taxon and that *R. stenopetalus* can be maintained in the British list. It seems that this bramble has a particular liking for clay soils capping chalk where it occurs as solitary bushes or small brakes. At Stockton Down it was accompanied by *Calluna vulgaris* and other heathy species. Muller (1859), however, refers to the habitat at its French locality, where it was rare, as sandy soil.

I have seen the following exsiccatae:
V.c. 8
Stockton Down, few bushes, GR 31/96.36, 1.8.1986, *A. Newton* (**herb. A.N.**).
Sunton Heath, few bushes, GR 41/26.53, 1.8.1986, *A. Newton* (**herb. A.N.**).
V.c. 11
Tytherley Common, one bush, GR 41/27.28, 7.7.1987, *D. E. Allen* (**herb. D.E.A.**).

V.c. 12

Itchen Wood, one bush, GR 41/52.53, 1.8.1986, *D. E. Allen* (**BM**). Bellevue plantation, Popham Beacons, GR 41/53.44, 13.8.1983, *D. E. Allen* (**herb. D.E.A.**).

Stratton Park, Micheldever, one clump, GR 41/54.42, 21.7.1975, *D. E. Allen* (**BM**).

Wolston Copse, Upton, colony, GR 41/3.5, 2.8.1986, *D. E. Allen* (**herb. D.E.A.**).

Hassock Copse, Lunnway Inn, Northington, GR 41/53.36, 1900, *W. L. W. Eyre* (**BM**).

Hassock Copse, frequent, GR 41/53.36, 7.8.1978, *D. E. Allen* (**BM**).

D. E. Allen sends the following supplementary information: "I have seen the following additional exsiccata of *R. stenopetalus* from v.c. 12:

Stratton Park, growing freely, GR 41/54.41, 1898, *W. L. W. Eyre* (**HME**).

Itchen Common, GR 41/52.35, [no date], *W. L. W. Eyre* (**HME**): det. Rogers as ?*R. pulcherrimus* × *rusticanus*.

Lawn Wood, GR 41/53.38, 3.9.1907, *W. L. W. Eyre* (**HME**).

Harewood Forest, GR 41/41.44, 26.7.1968, *E. S. Edees 20157* (**NMW**).

I also have field records from three further localities in v.c. 12: Micheldever Wood, GR 41/53.36 (frequent), Cobley Wood, GR 41/52.44 (scattered), and Long Copse, between Stockbridge and Crawley, GR 41/39.35 (two bushes). As at present known, the distribution is L-shaped, running from the north of Wiltshire down to the Hampshire border north-west of Andover and thence due east to the woods of the Micheldever area, which appear to be its headquarters."

REFERENCES

GROSE, D. (1957). *The flora of Wiltshire*. Devizes.

MULLER, P. J. (1859). *Pollichia* **16–17**: 194.

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POTAMOGETON FILIFORMIS PERS. IN ANGLESEY

Two species in *Potamogeton* subgenus *Coleogeton* Reichenb. occur in Great Britain: *P. pectinatus* L., characterised by open stipular sheaths and fruits over 3 mm long with a ventral beak, and *P. filiformis* Pers., with tubular sheaths and fruits less than 3 mm long with an apical beak. *P. pectinatus* is widespread but *P. filiformis* has a northern distribution. In Scotland it is most frequently found in lowland lakes and reservoirs, often near the sea, but it also grows in pools, flooded quarries, ditches, streams and rivers. In addition to its Scottish localities, *P. filiformis* is known from a single site in northern England, Rayburn Lake, Netherwitton, v.c. 67, and from Anglesey in Wales. Its occurrence in Anglesey, some 200 km south of the Northumbrian locality, is particularly interesting. It is not, however, clear from the available literature whether *P. filiformis* is still present there. Roberts (1982) stated that "recent records require confirmation", an opinion quoted by Ellis (1983). In view of this uncertainty I recently reassessed the Anglesey records of this species.

The first specimens of *P. filiformis* from Anglesey were collected at Cors Bodeilio by the Rev. H. Davies. A flowering specimen collected in May 1798 and a fruiting plant gathered in 1800 survive in **BM** and **NMW** respectively. Unfortunately the label on the specimen at **BM** was almost completely burnt away when the Natural History Museum was blitzed in 1940 (cf. Preston 1988), but the details of the locality had been recorded in J. E. Dandy's card index as "N. E. end of Cors Bodeilio". In Davies' day the taxa we now know as *P. filiformis* and *P. pectinatus* were not separated by British botanists (e.g. Hudson 1762, 1798; Smith 1800) although the variable *P. pectinatus* was sometimes split into more than one species. Davies named his plant *P. pectinatum* and published the record under this name (Davies 1813). The **BM** specimen was identified as *P. filiformis* by Arthur Bennett in 1883; the sheets at **BM** and **NMW** were both determined as this species by J. E. Dandy and G. Taylor. I have examined both specimens and agree that they are *P. filiformis*.

Further *P. filiformis* was collected (again as *P. pectinatum*) by W. Wilson on 16 July 1826 from the "southern lake of Llyniau Llanfihangel yn Nhywyn". Wilson noted that "it grew some of it out of the

water on the wet sandy shore, the lake being very low, owing to the dry summer". The specimen at **BM** bears ripe fruit; it was determined as *P. filiformis* by J. E. Dandy and G. Taylor and undoubtedly represents this species. According to Dandy's card index there is further material of this collection at **MANCH** and **K**. The Llynnau Llanfihangel yn Nhowyn, or Valley Lakes, are a group of lakes approximately centred on grid reference 23/320.770. It is not clear which of them Wilson intended by his phrase "southern lake".

The only subsequent records of *P. filiformis* from Anglesey are based on two specimens collected by R. H. Roberts in 1960, determined by J. E. Dandy and deposited at **BM.** The details are:

1. Llyn Llygeirian (S.W. side), Llanrhyddlad, GR 23/345.897, *R. H. Roberts*, 23 October 1960, det. J. E. Dandy, 1960, with note "leaf-sheaths tubular!".
2. Small pool by railway, Llangaffo, GR 23/435.692, *R.H. Roberts*, 18 December 1960, det. J. E. Dandy, 1961.

R. H. Roberts was unable to refind *Potamogeton filiformis* at either locality and so came to doubt the accuracy of these determinations. Both specimens are vegetative, and although collected at different sites they are fairly similar. I have examined them carefully and in my opinion they are not *P. filiformis*, but are a rather lax form of *Scirpus fluitans* L. Mr A. O. Chater has also examined the specimens and agrees that they are undoubtedly *S. fluitans*. *Scirpus fluitans* and *Potamogeton filiformis* are superficially similar in vegetative structure. Dandy was, of course, well aware of this similarity and occasionally had to determine as *Scirpus fluitans* material mistakenly sent to him in the belief that it belonged to *Potamogeton*. It is almost inconceivable that Dandy, whose determinations of *Potamogeton* are normally not only reliable but definitive, could have mistaken the two species. However I have had to conclude that he did so. It seems that even Dandy was no exception to David's (1981) dictum that "there is no botanical authority, however august, who has not been guilty of the grossest errors".

In conclusion, *Potamogeton filiformis* was collected at Cors Bodeilio (GR 23/5.7) by H. Davies in 1798 and 1800, and from Llynnau Llanfihangel yn Nhowyn (GR 23/3.7) by W. Wilson in 1826. Subsequent records from Anglesey are erroneous. Although *P. filiformis* may yet be rediscovered there, it seems more likely that it is now extinct. The species was more widespread in the last (Weichselian) glacial period than it is today (Godwin 1975), and the Anglesey populations were perhaps relicts dating from this time.

ACKNOWLEDGMENTS

I am grateful to A. O. Chater and R. H. Roberts for help, to the authorities at **BM** and **NMW** for the loan of specimens and to M. D. Hooper and P. D. Sell for reading a draft of this note.

REFERENCES

David, R. W. (1981). Gentlemen and players. *Watsonia* **13**: 173–179.
Davies, H. (1813). *Welsh botanology*, p. 18. London.
Ellis, R. G. (1983). *Flowering plants of Wales*, p. 164. Cardiff.
Godwin, H. (1975). *The history of the British flora*, 2nd ed., p. 365. Cambridge.
Hudson, W. (1762). *Flora Anglica*, pp. 62–63. London.
Hudson, W. (1798). *Flora Anglica*, 3rd ed., pp. 76–77. London.
Preston, C. D. (1988). The *Potamogeton* L. taxa described by Alfred Fryer. *Watsonia* **17**: 23–35.
Roberts, R. H. (1982). *The flowering plants and ferns of Anglesey*, p. 60. Cardiff.
Smith, J. E. (1800). *Flora Britannica* **1**: 197–198. London.

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SOME NEW COMBINATIONS IN THE BRITISH FLORA

In Rich & Rich (1988) I used the following invalid names and combinations and take this opportunity to validate them.

Pseudotsuga menziesii subsp. **glaucescens** (Schwerin) P. D. Sell, **comb. nov.**
P. taxifolia subsp. *glaucescens* Schwerin in *Mitt. Deutsch. Dendrol. Ges.* **1922**: 61 (1922).
P. glaucescens sensu Bailly in *Rev. Hort.* **1895**: 88 (1895), quoad descript. exclud. basionym.

Cedrus libani subsp. **atlantica** forma **glaucissima** P. D. Sell, **nom. nov.**
C. atlantica var. *glauca* Carrière, *Traité gén. Conif.*, 2nd ed., 374 (1867), non *C. libani* var. *glauca* Carrière, *Traité gén. Conif.* 284 (1855).

Cedrus libani subsp. **deodara** (D. Don) P. D. Sell, **comb. nov.**
Pinus devdara Roxb., *Hort. Bengal.* 69 (1814), nom. nud.
Pinus deodara D. Don in Lamb., *Descr. Pinus* **2**: 8 (1824).

Cryptomeria japonica subsp. **sinensis** (Miq.) P. D. Sell, **stat. nov.**
C. japonica var. *sinensis* Miq. in Sieb. & Zucc., *Fl. Jap.* **2**: 52 (1870).

Fumaria muralis subsp. **boraei** var. **major** (Boreau) P. D. Sell, **comb. nov.**
F. bastardii var. *major* Boreau in Duchartre, *Rev. Bot.* **2**: 359 (1847).

Pilosella peleteriana subsp. **subpeleteriana** (Naegeli & Peter) P. D. Sell, **comb. nov.**
Hieracium peleterianum subsp. *subpeleterianum* Naegeli & Peter, *Hier. Mittel-Eur.* **1**: 129 (1885).

Pilosella praealta subsp. **thaumasia** (Peter) P. D. Sell, **comb nov.**
Hieracium magyaricum subsp. *thaumasium* Peter in *Bot. Jahrb.* **5**: 284 (1884).

REFERENCE

Rich, T. C. G. & Rich, M. D. B. (1988). *Plant crib*. London.

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THE TYPIFICATION AND NOMENCLATURE OF *ERICA MACKAIANA* BAB.

In volume 1 on page 158 of *Companion to the Botanical Magazine*, Hooker (1835) discusses the discovery of a new *Erica* from Ireland which is provisionally (but not validly) given the name *Erica mackaii*.

The species was validly described as *E. mackaiana* on page 181 of *Flora Hibernica* (Mackay 1836), the authorship being attributed to C. C. Babington both in the authority of the name "*E. mackaiana* Babington" and after the description "Bab. MSS", and by Babington (1836) himself on page 456, vol. 17 of *Transactions of the Linnean Society of London* in the same year. Neither publication refers to the other. The descriptions are identical except that one is in English and one in Latin. I have been unable to find out which was published first, but J. E. Dandy, in his manuscript of citations which go with the *List of British Vascular Plants* (Dandy 1958), gives only *Flora Hibernica*, suggesting he had come to that decision.

The locality in *Flora Hibernica* is given as "On the declivity of a hill by the roadside within three miles of Roundstone, Cunnamara; Mr. W. M'Calla". Hooker also gives the finder of the plant as M'Calla. In *Trans. Linn. Soc. Lond.* the locality is given as Craigha Moira, Connemara (Babington 1836).

Both Babington's descriptions would be based on the specimens collected by him in 1835. In the herbarium at Cambridge (**CGE**) there are five sheets that can be regarded as syntypes.

1. *Erica* (*biformis* [crossed out]) *Mackaiana*, Craigha Moira, Connemara, 2 Sept. 1835, taken to the place and plant by W. McCalla of Roundstone. Herb. C. C. Babington [All in Babington's handwriting].
2. *Erica* (*biformis* [crossed out]) *Mackaiana*, Craigha Moira, Connemara, 2 Sept. 1835, Herb C. C. Babington [All in Babington's handwriting].
3. *Erica Mackaiana*, *Erica biformis*, Craigha-moira, Connimara, 4 Sept. 1835, *C. C. Babington*. Mus. Henslow [In Henslow's handwriting].
4. *Erica biformis*, Croiga Moira, Cunnamara, west of Ireland, Aug. 1835, Ex Herb. C. C. Babington [In an unknown hand].
5. *Erica biformis* Babington, Cunnemara, Ireland Babington, E. tetralicis vix var. Herb. C. M. Lemann [In an unknown hand].

It would appear from Babington's diary (Babington 1897, p. 46), and from the two specimens in his handwriting the only day on which he actually looked at *Erica mackaiana* (in the company of Messrs McCalla and Lingwood) was on 2 September, despite the fact he says "August" in *Trans. Linn. Soc. Lond.* (Babington 1836). The dates on the other sheets are probably wrong. I have selected sheet one as the lectotype. Sheet 2 certainly and probably sheets 3, 4 and 5 are isolectotypes. Specimens given by Babington to Mackay (see *Flora Hibernica*) and probably to other botanists would also be isolectotypes.

All five sheets are morphologically similar and fit the original description with the exception that the leaves are lanceolate or oblong-lanceolate, not ovate. All have glandular hairs on the margins of the leaves, the stems, and the calyx. I think we must assume that this leaf-shape is what Babington called ovate.

Hooker (1838) validly published *E. mackaii* in the fourth edition, page 158 of *The British Flora*, but in citing *E. mackaiana* as a synonym he made it an illegitimate name. The full synonymy is as follows:–

Erica mackaiana Bab. in Mackay, *Fl. Hibern.* 181 (1836); in *Trans. Linn. Soc. Lond.* **17**: 456 (1836).
Lectotype: Craigha Moira, Connemara, 2 Sept. 1835, *C. C. Babington* (**CGE**), designated here.
E. mackaii Hooker, *Compan. Bot. Mag.* **1**: 158 (1835), nom. provis., non rite publ.; *Brit. Fl.*, 4th ed. 158 (1838), superfl. nom. illegit. pro *E. mackaiana* Bab.
E. tetralix subsp. *mackaiana* (Bab.) Syme in Sowerby, *Eng. Bot.*, 3rd ed. **6**: 38 (1866).
E. ciliaris subsp. *mackaiana* (Bab.) Moore & More, *Contrib. Cyb. Hibern.* 183 (1866).
E. tetralix subsp. *mackaii* Hooker fil., *Stud. Fl. Brit. Is.* 233 (1870), superfl. nom. illegit. pro subsp. *mackaiana* (Bab.) Syme via basionymum.

REFERENCES

Babington, C. C. (1836). On several new or imperfectly understood British and European plants. *Trans. Linn. Soc. Lond.* **17**: 451–464.
Babington, C. C. (1897). *Memorials journal and botanical correspondence*. Cambridge.
Dandy, J. E. (1958). *List of British vascular plants*. London.
Hooker, W. J. (1835). Another heath found in Ireland. *Compan. Bot. Mag.* **1**: 158.
Hooker, W. J. (1838). *The British flora*, 4th ed., p. 158. London.
Mackay, J. T. (1836). *Flora Hibernica*. Dublin.

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NEW ZEALAND SPECIES OF *HYDROCOTYLE* (APIACEAE) NATURALISED IN BRITAIN AND IRELAND

Ten species of *Hydrocotyle* (nine indigenous, one naturalised) are treated in the most recent volume of the *Flora of New Zealand* (Webb, Sykes & Garnock-Jones 1988). Four of these have become

locally common lawn weeds in New Zealand (Webb 1982, 1984). The genus still presents taxonomic difficulties with as many as six taxa included in the *H. novae-zeelandiae* complex, and the *H. moschata*/*H. microphylla* complex as yet not fully resolved.

In the most recent edition of the *Flora of the British Isles*, Tutin (1987) accepts only one naturalised species, *H. moschata* G. Forster; this is endemic to New Zealand and has established in lawns and grassy banks on Valencia Island, south-western Ireland.

Examination of herbarium material from **RNG** has revealed that two further New Zealand taxa are naturalised in Britain. Both collections on sheet 5,82/4 (Lawn at Parkhill, Arbroath, Angus, v.c. 90, *U.K. Duncan*, Aug 1961; Spontaneous weed in garden, W. Cornwall, *Miss Wood*, comm. D. McClintock, 1968) represent *H. novae-zeelandiae* DC. var. *montana* Kirk. Both these collections had been identified as *H. microphylla* Cunn. another New Zealand species. The leaves of *H. novae-zeelandiae* var. *montana* are similar to those of *H. microphylla* but *H. novae-zeelandiae* var. *montana* differs in having very stout stolons, much larger fruits, and a higher chromosome number. Var. *montana* also differs from *H. novae-zeelandiae* var. *novae-zeelandiae* in chromosome number (Webb & Beuzenberg 1987) and will be treated as a distinct species when a revision of this complex is completed.

Sheet 5,82/3 comprises four collections. The first, from Valencia Island, represents typical New Zealand *H. moschata* G. Forster. The other three collections (Covering lawn of 26, Broadwater Down, Tunbridge Wells, W. Kent, v.c. 16, *K. E. Bull*, 1958; Cult. ex lawn 26, Broadwater Down, Tunbridge Wells, W. Kent, v.c. 16, *D. McClintock*, May–July 1959; 16th green and nearby on Kelburn Golf Course, Largs, Ayrshire, comm. *D. McClintock*, 21 July 1953) had been variously determined as *H. sibthorpioides* Lam., *H. microphylla* Cunn., and *H. moschata* G. Forster. These three collections represent a small-leaved variant indigenous to northern areas of the North Island of New Zealand and belonging to the *H. moschata*/*H. microphylla* complex. Such plants are presently referred to *H. moschata* but differ from the typical variant of that species (represented by the Valencia Island plants) in the smaller, less dissected leaves and in having hairs usually only on the upper surface of the lamina. This taxon also appears similar to *H. microphylla* which is, however, usually clearly distinguished from both variants of *H. moschata* by its rounded leaf teeth and glabrous upper and lower lamina surfaces. Both kinds of *H. moschata* and *H. microphylla* have a chromosome number of 2n = 48 (Webb & Beuzenberg 1987). The small-leaved variant of *H. moschata* has been recognised in New Zealand for some time and annotations on herbarium specimens indicate that British botanists have also recognised that it differs from the *H. moschata* found on Valencia Island and described by Tutin (1987). However, it is not always easy to distinguish this taxon from *H. moschata* sensu stricto and *H. microphylla* and so it remains unclear what taxonomic recognition if any it should be given.

Some 50% of the 1470 dicotyledons, gymnosperms and pteridophytes naturalised in New Zealand have come from Europe and undoubtedly most have come directly or indirectly from Britain (Webb, Sykes & Garnock-Jones 1988). It is pleasing to see *Hydrocotyle* making some attempt at reciprocity. Further species of *Hydrocotyle* may be naturalised in Britain and Ireland, and those species recorded in this note may well have wider distributions. I am willing to examine any material of naturalised *Hydrocotyle*.

KEY TO PENNYWORTS (*HYDROCOTYLE*) WILD IN BRITAIN AND IRELAND

1. Leaf lamina peltate, glabrous ..... *vulgaris*
1. Leaf lamina with deep basal sinus, glabrous or hairy ..... 2.
2. Leaf teeth crenate; fruit 2–3·5 × 1·8–2·5 mm ..... *novae-zeelandiae* var. *montana*
2. Leaf teeth serrate; fruit 1·3–1·5 × 1–1·3 mm ..... 3.
3. Leaf lamina hairy on upper and lower surface ..... *moschata* sensu stricto
3. Leaf lamina hairy on upper surface only ..... *moschata* 'small-leaved variant'

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I thank the Herbarium Curator, **RNG**, for the loan of material of naturalised *Hydrocotyle*.

REFERENCES

TUTIN, T. G. (1987). Umbelliferae, in CLAPHAM, A. R., TUTIN, T. G. & MOORE, D. M. *Flora of the British Isles*, 3rd ed. Cambridge.

WEBB, C. J. (1982). Hydrocotyles in your garden. *J. Canterbury Bot. Soc.* **16**: 68–72.

WEBB, C. J. (1984). The correct name for our commonest lawn *Hydrocotyle*. *J. Canterbury Bot. Soc.* **18**: 70–71.

WEBB, C. J. & BEUZENBERG, E. J. (1987). Contributions to a chromosome atlas of the New Zealand flora – corrections and additions to number 21 Umbelliferae (*Hydrocotyle*). *N.Z. J. Bot.* **25**: 371–372.

WEBB, C. J., SYKES, W. R. & GARNOCK-JONES, P. J. (1988). *Flora of New Zealand*, **4**. *Naturalised pteridophytes, gymnosperms, dicotyledons*. Christchurch.

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Book Reviews

The illustrated Flora of Britain and northern Europe. M. Blamey & C. Grey-Wilson. Pp. 544, with 447 pp. of colour illustrations, 1 map, and numerous text illustrations. Hodder & Stoughton, London. 1989. Price £25 (ISBN 0–340–41072–2).

The first impact of this book is of a beautiful Flora with illustrations on, or round, almost every page. The paintings are the main feature, with Marjorie Blamey's name first in the title heading. Over 2,400 species are illustrated, nearly all in colour and in particularly pleasing layout; between five and 12 plant paintings shown on each large (17 × 26 cm) illustration page, and additionally fringing the opposite page of text a wealth of marginal detailed paintings, adding much to both the informativeness and the attractiveness of the book.

The text, which complements the illustrations, is based on *Flora Europaea* (with acknowledgement to D. H. Kent for his survey of the nomenclature used). Sections of the Introduction give reasons for name changes and explain the use of authorities and synonyms (but not the definition of a species), and also deal with flower structure and habitats. A Glossary, clearly illustrated by line drawings, and Latin and English indices, are helpful to beginners using this Flora.

The main area covered is illustrated by a map and covers northern and north-western Europe from the Alps (but excluding these) and south-central France northwards. For species which occur in Britain, more detailed distribution notes are given, these indicated by a bold 'B', but a few are without, e.g. *Asparagus officinalis* subsp. *prostratus* and *Zostera noltii*. Ireland is treated separately, and as one geographical island – but *Lysichiton americanum* is mentioned only for Ireland, although well-naturalised in Sussex for many years. Added interest is given to the distribution by stating the country of origin of those plants introduced from outside Europe. Although no grasses, sedges or rushes are included, there are broad surveys of *Taraxacum* and *Rubus*, *Salix* spp. are painted and described, and there is a good section on planted conifers. Introduced plants considered as the most likely to be seen are included.

However, I do have reservations on the practical use of this Flora. The emphasis is on field identification and the arrangement is as a field guide, although its size and weight (1,720 g) decree that it is not intended for use in the field. This possibility lessens the usefulness of the detailed diagnostic characters illustrated, as collection is now in general discouraged. Careful advance study of these details could direct the serious fieldworker to note on site those important specific features. The stated aim is for the amateur naturalist and general reader, but a Flora most useful to these for field identification would be limited to the native and most commonly encountered introduced plants of the British Isles only. More serious misgivings are caused by the arrangement of the plants under English names. Although an obvious help to the beginner and general reader, much of the subject matter is useful to the more experienced field botanist, such as the critical *Euphrasia* spp., of which 29 are described and illustrated and a further eight infraspecific taxa mentioned. The design first directs one to the pictures which are captioned in English but not numbered; finding the Latin name in the text presents a succession of checks.

The printing has reproduced the natural flower colours well, with very few exceptions. *Rubus chamaemorus* has two berry colours on facing pages, only one close to the soft apricot orange of the ripe fruits. The illustration of *Euphorbia peplus* has missed the unequal leaf bases characteristic of the species, and *Saxifraga stellaris* is shown less upright and stouter than usual forms; a more helpful detail of *Baldellia ranunculoides* could be the fruits (distinguishing it from *Alisma* spp.), rather than the pair of petals shown. Particularly helpful are the maximum and minimum size paintings, such as of *Myosotis* flowers, and sections showing the arrangements of hairs on *Thymus* stems. These are minor points in relation to the scale of this work, and the book is commended. The occasional vignettes of countryside scenes are a delight, and the "lifelong study, lifelong pleasure" quoted as the artist's approach are very evident. Overall, the book will give much pleasure to many, is interesting, informative and attractive to browse, and it should surely encourage enthusiasm for wild flowers.

M. Briggs

The correspondence of Charles Darwin, Vol. 4, 1847–1850. Edited by F. Burkhardt & S. Smith. Pp. xxxiii + 711. Cambridge University Press, Cambridge. 1988. Price £32.50 (ISBN 0–521–25590–2).

Three hundred and eighty-two pages of this volume are taken up with the correspondence, with rather more occupied by supplementary matter. The appendices comprise a chronology (5 pp.), an essay on Darwin's study of the Cirripedia (barnacles) (22 pp.), his observations on his children (23 pp.) and his 'reading notebooks' (139 pp.). In addition, there are comments on the manuscripts (27 pp.), a bibliography (25 pp.), a biographical register (45 pp.) and an index (37 pp.).

This volume encompasses part of the period when Darwin was more concerned with barnacles than with plants. The major part of the correspondence is taken up with his search for information about, and specimens of, these creatures, as well as with his geological interests. J. D. Hooker, who from the number and tone of their letters was clearly now a close confidant of Darwin, left on his expedition to the Indian subcontinent in late 1847. Whilst, in some letters, Hooker communicated his enthusiasm for understanding the relationships of the N. Indian floras, he was largely concerned to answer Darwin's question about glacial action, mountain orogenesis and so on. He also complained about his agent who did not forward communications from England for months at a time. In one letter, dated 26 November, 1850, Hooker wrote "I should not quite say he sends me *nothing* – for today an English parcel with some rubbishy proofs of *Victoria regina* from Mr Reeves [his publisher], which I don't care one rush about and have given away forthwith". Has much, except the language, changed in the past 138 years?

Of botanical interest, also, is the correspondence between Darwin and Hooker on the reasons for the affinities of plants in the cool temperate Southern Hemisphere. Darwin considered that seeds etc. could have migrated between Australasia and South America by means of icebergs, driftwood, sea-currents, and so on; Hooker demurred, though his alternative ideas are hard to discern.

Botany apart, this volume will be of great interest to many members of B.S.B.I. It continues to provide an insight of Victorian society and its mores – the courtesies, at least as written, are noteworthy. Darwin continues to attend meetings of learned societies in London, but shows increasing signs of his real or imagined infirmities, rejecting various invitations to meet or dine with colleagues, including some of his shipmates from the *Beagle* voyage.

Those who expect the high scholarship, detailed documentation and excellent production of the first three volumes of the *Correspondence* will not be disappointed. This volume continues a distinguished editorial and publishing venture.

D. M. Moore

The Contented Botanist. Letters of W. H. Harvey about Australia and the Pacific. Edited by S. C. Ducker. Pp. xvi+413. Melbourne University Press, Melbourne. 1988. Price A$65.95 (ISBN 0–522–84341–7).

W. H. Harvey was born in Limerick, Ireland in 1811 of Irish Quaker stock. Not being a member of the Established Church he was excluded from attending Trinity College Dublin although later he was to become Professor of Botany at Trinity as well as retaining his Professorship of Botany of the Royal Dublin Society. His botanical education was due very much to his own efforts but his talents were soon recognised by leading botanists including Sir William Hooker with whom he kept close contact throughout his career. Although primarily interested in algae, throughout his life he worked actively with all groups of plants. He is probably best known here for his *Manual of British marine algae*. For many years his ambition was to collect in Australia and the title chosen by Dr Ducker for the collection of his letters records the achievement of his ambition.

The letters published, which cover the period 1852–64, were chosen to show how Harvey prepared for the journey and the day to day problems he experienced. While most of the letters were written to Asa Gray or his wife in America or to Sir William Hooker or his son there is also a fair sprinkling of family letters. They contain many items of interest to historians in Australia as well as records of the plants he saw and collected although algae, his first love, predominate.

It is very difficult to judge what is the market for such a book. If the contents of the letters had been digested and presented in narrative form they could well have made a most interesting

biographical travel book as the 17 pages of introduction show. The curtailment of his field work in Tonga because the local Chief had recently been killed and eaten is a problem not many of us have encountered, although we have all suffered transport problems in getting our specimens safely home, but to publish so many letters in full is difficult to understand as there must be few people who would wish to read them. Often the same information is contained, perhaps in a slightly different form, in two or three very similar letters written to different people. Dr Ducker has rendered a valuable service in locating the correspondence and in making its locations known and one cannot but be impressed by the care and skill that she has shown in completing her editorial task. Nevertheless it would seem that with all the modern facilities for storage and retrieval of data and the ease of facsimile reproduction of documents, the age of publishing verbatim large collections of letters has gone.

N. A. Burges

The origins of Angiosperms and their biological significance. Edited by E. M. Friis, W. G. Chaloner & P. R. Crane. Cambridge University Press, Cambridge. 1989. Price £15 (paperback) (ISBN 0–521–31173–X).

The facts and the conclusions presented in this book show how far the study of angiosperm palaeobiology has progressed in the last twenty years. Views on angiosperm evolution are no longer in the hands of taxonomists or morphologists studying extant plants. It is now feasible to give structured accounts of the changing form of angiosperms and their flowers with geological time, to show their probable co-evolution with insect pollinators and herbivores, and to indicate possible interactions with dinosaurs and other herbivorous tetrapods. Reconstructions of whole ecosystems can even be attempted when fossils are abundant, although unfortunately the incompleteness of the fossil record rarely allows this.

The chapters are on the whole clearly written with original data often giving the factual bases upon which the authors' reasoning rest. The diagrams are clear although more of them would have been welcome. Unfortunately this is not a fully structured account covering all aspects of angiosperm evolution and palaeobiology. It is instead a collection of papers, originating from a 1985 symposium, that summarise a number of views on different aspects of angiosperm evolution and palaeobiology. The cover's claim that the book was written specifically for use by advanced students is rather misleading, although the additions of an introduction to angiosperms, a glossary, a stratigraphic table and a conspectus of animal and plant classification give it some overall cohesion.

This is not a new book, being originally published as a hardback in 1987. The hardback edition sold well, but it is good now to have it more within the price range of students and other interested readers. It is a book well worth reading if you are at all interested in the subject.

B. A. Thomas

The flora of Derby. K. Futter & P. Raynes. Pp. 62, with 7 maps (1 in colour) and 6 colour plates. Privately published, 1989. Price £2 + 50p postage from Peter Raynes, 4 Petersham Drive, Alvaston, Derby, DE2 0JU (ISBN 0–9514607–0–6).

The north midlandshire industrial city of Derby would seem to be an unlikely place to be the subject of a Flora. However, the work reveals that the city area is composed of 36 per cent of 'green space', approximately 2784 hectares, a situation common to many other urban areas. A varied geology gives rise to contrasting topography and soil types, with further variety provided by the River Derwent and its tributary streams.

The flora of Derby is a result of the Derby City Wildlife Project, instigated by the Derbyshire Wildlife Trust under the Community Programme in 1987, but is a freelance piece of work by the authors who were involved in the Project, helping to carry out a detailed biological survey of the city.

The City Wildlife Project is itself an outcome of the increasing interest in the value of urban

wildlife and the need for its conservation, and a primary aim was to assist the Derby City Council planning department in the formulation of a nature conservation strategy.

The main body of the work consists of a consideration of each habitat type, where the best of them are to be found, and an evaluation of the various species contained in them. Some localities have proved to be very rich. A few woodlands equal some of the best in the county, with herbs such as Moschatel, Yellow Archangel and Hairy Woodrush. Adder's-tongue Fern is abundant in a damp field, while an old railway station site in the City centre shelters such unexpected species as Kidney Vetch and Lesser Broomrape. There is also a comprehensive list of plants arranged in alphabetical order by scientific name, with a coding system indicating habitat and relative abundance.

A short chapter deals with the threats to these habitats in the constantly changing environment of an industrial city. I would have liked to have seen a few photographs of general habitats, rather than just of individual species. The rather nice line drawings are dotted throughout the text merely as decoration and are not captioned – and space could have been found to include more of these. I would have liked to have seen the section on Derby's geology augmented with a consideration of the City's relationship to the surrounding countryside in terms of its wildlife, together with a note on climate.

This is a well written and attractively produced publication, and is a credit to the hard work and enthusiasm of the authors. It should form a sound basis for attempts to safeguard wild habitats within the City and for further study.

W. Grange

Morphology and evolution of vascular plants. E. M. Gifford & A. S. Foster. Pp. viii + 626, with 378 illustrations. W. H. Freeman & Co. Ltd., Oxford. 1989. Price £39.95 (ISBN 0–7167–1946–0).

Though the title is different this is the third edition of Foster & Gifford's classic book the *Comparative morphology of vascular plants*. In this edition the text has been extensively re-written (it is 125 pages shorter), many new plates and figures added, the references brought up-to-date and the scheme of classification changed. This latter change has very little effect on the structure of the text, and is clearly presented, early on, in a Table. The scope of the book remains similar.

There are 20 chapters: the first six cover basic plant morphology, key features of vascular plants, the vegetative sporophyte, sporangia, gametangia and embryogeny (74 pages). The rest of the book describes all known groups of fossil and living vascular plants (421 pages) and concludes with two chapters on the angiosperms (131 pages). The rather unsatisfactory chapter on angiosperm fruits, seeds and seedlings in the second edition has been omitted – a pity, I would rather it had been improved and expanded.

Much new information appears in this latest edition: the Charophyceae (stoneworts) are the most likely progenitors of the land plants; *Cooksonia* is the most primitive vascular plant yet found; *Rhynia* (now called *Aglaophyton*) is not a vascular plant at all; the sub-division of *Lycopodium* is discussed and justified; a cladistic classification of the ferns is presented; primitive angiosperms were very diverse in floral form and not all like *Magnolia*; *Sanmiguelia* (a potential angiosperm fossil from the *Triassic!*) is discussed and pollination and fertilisation in angiosperms is dealt with in detail.

The book is outstandingly well written, illustrated and proof-read. The literature has been thoroughly searched (references from 1988 are cited) and few standard texts have been omitted.

This, then, is a wonderful, scholarly book and a great advert for conventional botany. Unreservedly, I recommend it.

J. Parnell

The names of plants, 2nd edition. D. Gledhill. Pp. vi+202, with 6 line drawings. Cambridge University Press, Cambridge. 1989. Prices: paperback £8.95 (ISBN 0–521–36675–5); hard covers £22.50 (ISBN 0–521–36668–2).

The second edition of this little book, which is aimed at being "equally acceptable to the amateur gardener as to the botanist", now includes "brief comments on both synonymous and illegitimate names and a reference to recent attempts to accommodate the various traits and interests in the naming of cultivated plants". The author has remedied the faults pointed out by Arthur Chater in his review of the first edition (*Watsonia* **16**: 201 (1986)).

The first part, on the naming of plants, is less confusing than it was; but it is still not free from inaccuracies and misleading statements. For example: (p. 19) only the 5th edition of Linnaeus, *Genera plantarum* (1754) is associated with the starting point for the naming of species (*Species plantarum* (1753)), not the 6th edition (1764); (p. 21) surely the need to recognise entities below the rank of species is not dependent on the type concept?; (p. 30) the stem to which the suffix *-aceae* (family) is added is only *part*, not the whole, of the generic name, e.g. *Ranuncul-*, not *Ranunculus*; (p.39) geographical epithets are *not* among those permitted to be spelled with an initial capital letter.

In the second part (the glossary), the author has added "many commemorative generic names". Although it is clearly impossible to be inclusive in this regard, I should have liked to see some more names that amateur gardeners frequently encounter, such as *Kirengeshoma* and *Stewartia*, as well as epithets such as *mlokosewitchii*. Some commemorative epithets are attributed to only one of two or more eponyms (e.g. *alstonii*, *andersonii*). Geographical names and epithets are treated somewhat unevenly; for example, *yunnanensis* is in, but not the 'difficult' *kouytchensis* (from Kweichow = Guizhou); and *armeniacus* usually means what it says (from Armenia), only being a mistake for China in the case of the apricot (*Prunus armeniacus*). I would also take issue with the author when he defines *alpicolus* as "of high mountains"; *-icola* is a feminine noun suffix derived from *incola* (inhabitant). Thus *alpicola* means 'inhabitant of alps or The Alps'; *alpicolus* does not exist. Finally, there are errors in terminology. The definition of *acuminate* "with a long, narrow and pointed tip" and Fig. 7(c) are inaccurate; *acuminate* means 'gradually coming to a point'. Again; *pedate* (Fig. 5(b)) does not mean "palmate but with the lateral divisions subdivided"; it means that the upper (palmate) divisions are separated from the lower ones by a piece of rhachis (*pes* = foot).

In summary, this is a useful introduction to plant naming and to the meanings of plant names; but it still needs to be used with caution.

N. K. B. Robson

Atlas der Farn- und Blütenpflanzen der Bundesrepublik Deutschland. H. Haeupler & P. Schönfelder. Pp. 768 with 96 colour plates, and 2490 plant distribution maps. Eugen Ulmer, Stuttgart. 1988. Price 68DM (ISBN 3–8001–3434–9).

This magnificent volume from W. Germany adds a very large piece to the jigsaw of our knowledge of the distribution of vascular plants in Europe extending as it does through 8° of latitude and longitude. Work on the *Atlas* began nearly 25 years ago inspired, in part, by the publication of the *Atlas of the British flora* in 1962.

The mapping unit was based on dividing degrees of latitude and longitude into 6′ and 10′ respectively which is a 'square' only a fraction larger than 10 × 10 km. This gave a total of 2084 units, including 8 for the 'island' of W. Berlin which is shown in position on the base map without increasing its size – some parts of 'mainland' W. Germany are further east than W. Berlin!

That the work took so long to complete is hardly surprising when it is realised that their flora includes at least 50% more species than ours – the highest number per square was 1481 around Hamburg (including a few dock aliens and alien docks?) with an average of 630.

The bulk of the *Atlas* comprises 2490 distribution maps beautifully presented on a coloured background showing main rivers and altitude. A variety of symbols is used to distinguish pre- and post-1945 records as well as the 'status' of the species (native, introduced etc.). Interpretation is further assisted by the inclusion of 30 transparent overlays covering climate, geology and soils. There are short critical comments on about 900 of the maps and 96 high quality colour plates of local species, mainly non-British.

A major interest of the *Atlas* for BSBI users must be what it discloses about our species further east in Europe and particularly their past and present distribution. Here almost every double-page

spread of eight maps reveals species in decline – and frequently they are those which are also threatened in the British Isles. Wetland species such as *Apium repens*, *Hammarbya paludosa*, *Liparis loeselii*, *Saxifraga hirculus* and *Ludwigia palustris* are now very rare or extinct over wide areas – especially in the North German Plain and, in the more mountainous south, meadow species such as *Orchis ustulata* are disappearing rapidly.

Facts like these emphasise the need for us to work more closely with our colleagues in Europe to devise a strategy for protecting the flora and to prepare a new up-to-date *Atlas* of Great Britain and Ireland. If this publication inspires us to complete that task the wheel will surely have turned full-circle. Happily for a book which is a credit to the authors and their publishers the costs of buying inspiration are relatively modest (about £22 in this country) when compared with a volume of *Flora Europaea* only half the length at £85!

F. H. Perring

Current Paleoethnobotany: analytical methods and cultural interpretations of archaeological plant remains. Edited by C. A. Hastorf & V. S. Popper. Pp. xii + 236. The University of Chicago Press, Chicago. 1989. Price £7.95 paperback (ISBN 0–226–31893–1).

Techniques for the extraction of macrofossil plant remains ("floral material") from archaeological sites have evolved rapidly over the past few decades in the U.S.A., as they have done in Europe. Not only has this provided interesting and statistically valid information, as well as showing the potential for further work, but it has meant that palaeobotanists have had to consider very carefully how to analyze and interpret the large bodies of data produced.

Based on the papers presented at a Symposium in 1985 for the Society for American Archaeology, the chapters contain critical discussions on the techniques of sampling, recovery, quantitative measurement, statistical analysis and interpretation of plant remains. This is mainly limited to charred remains on prehistoric sites. Each chapter is well referenced, providing a useful American bibliography.

Many of the issues raised will interest British archaeobotanists who have been going through similar discussions on topics such as, for example: the archaeological processes which affect the botanical evidence; how best to quantify data to provide inter-site compatibility; and the statistical validity of the data for the interpretation of crop processing activities or changes of plants used through time. New methods, such as the rapid scanning of very large numbers of samples from complex sites in order to work cost-effectively and provide broad distribution patterns, are being developed in parallel to ours.

If you can cope with the American archaeological jargon, this is a readable and thought-stimulating book.

P. R. Tomlinson

Travels in China. A plantsman's paradise. R. Lancaster. Pp. 516, with numerous colour and black and white photographs and 9 sketch maps. Antique Collectors' Club, Woodbridge, Suffolk. 1989. Price £29.50 (ISBN 1–85149–019–1).

To call Roy Lancaster just a gardener would be to belittle him. He is above all a plantsman with a strong botanical inclination, who has made it his mission in life to discover as much as he can about the plants that grow in our gardens and to transmit this information by speaking, writing and broadcasting. In so doing, he has done as much as any living person to bridge the unfortunate and unnecessary gap that exists between botanists and gardeners. It is not surprising, then, that this sumptuously illustrated book is no mere account of his travels in China. As well as that – a tale well and interestingly told – it is a historical review of plant collecting in China and a guide to whence and when very many well known plants reached our gardens; and it includes chapters on Chinese place names and botanic gardens. I can almost guarantee that the most field-orientated member of the

B.S.B.I. will find this a fascinating account of an admittedly distant region, which has a flora that is similar in aspect to that of Europe, but one that is so very much richer.

N. K. B. Robson

A guide to the wild orchids of Great Britain and Ireland. D. Lang. Pp. 233, with 36 colour plates and 53 maps. Second edition. Oxford University Press, Oxford. 1989. Price £8.95 (ISBN 0–19–282599–2).

There is still a great interest in British orchids and despite several recent publications on this fascinating group of plants, the general demand for information is always welcome. The first edition of this book appeared in hardback in 1980, and this new edition has the additional merit of being a paperback, which encourages one to 'pocket it' when going out into the field. The introductory chapters on the structure of flowers, germination, growth and reproduction remain essentially the same, and are clear, simple statements of complicated subjects. Recent advances have been made particularly regarding seed germination and growth, and it is disappointing that these are not integrated into the text in this new edition. For example, it is now widely accepted that the Bee Orchid is not monocarpic, and that many species can flower after three years above-ground growth. However, the bibliography has been updated and the reader can benefit from this, and delve further into the literature if so inclined.

There is an area of mystery about orchids and where to find them, and the book contributes to this by telling us the various species associated with the different habitats, and by not giving precise localities, thus leaving the enthusiast with some further homework. The distribution maps inform us in which vice-counties individual species are to be found, but the heavier type-face used to denote their presence is not immediately distinguishable from the lighter setting, indicating absence.

The main strength of the book is in the detailed description of each species and the excellent colour plates, which are well produced. Several new illustrations are included, and especially welcome are the different marsh orchids, a whole plant of *Epipogium aphyllum*, and the two new recently confirmed species *Dactylorhiza lapponica* and *Epipactis youngiana*. A variant of *E. youngiana* was recently found on a B.S.B.I. outing near Glasgow, but the parentage and taxonomic status have yet to be verified. What is disappointing is the lack of names by the colour plates. Although the expert may have no difficulty in distinguishing the species, the less erudite reader has to keep returning to the list of species at the front to look up the reference number. The lack of page-numbering here is also a disadvantage. A clear listing of page numbers for text, colour plate and distribution map for each species would have helped enormously, and made it much easier for the general user. However, the quality of the text printing and that of the plates will undoubtedly appeal to the majority and make it another successful book on orchids.

L. Farrell

Ferns: their habitats in the British and Irish landscape. (A natural history of Britain's ferns.) C. N. Page. Pp. 430, with 21 colour photographs, numerous monochrome photographs and 14 maps and line-drawings. Collins New Naturalist, London. 1988. Price £30 hardback (ISBN 0–00–219383–3), £10.95 limpback (ISBN 0–00–219382–5).

This is a very enjoyable addition to the Collins' New Naturalist series. It could well have been subtitled 'ecology made interesting' or 'how to think about the plants you see', but citing this volume is complicated enough with four titles given (three on the cover). It should be known as 'A natural history of Britain's ferns', for this is what it is. The fern allies are covered as well.

The chapter titles read sedately, covering the major habitats. But within each there is a wealth of fascinating information drawn from the author's extensive exploration of the British Isles and gleaned from his wide reading. His discussion ranges well beyond the usual distribution constraints of acid or calcareous substrates, precipitation and temperature, to cover palaeo-history, archaeo-logy and land-use. The importance given by Page to dense cloud-cover and grazing is interesting.

The latter carries the implication of destruction of mature plants rather than prevention of establishment of new individuals. The geological information may be initially rather indigestible and need re-reading, but to those like myself with scant knowledge of this field, it is a relief to be able to gain some understanding of the otherwise mysterious occurrence of some microhabitats. The three appendices, presenting a check-list of British ferns and allies, their overwintering strategies and hybrid data, are most useful additions to the main work.

Comprehensive as this book is, it still leaves food for thought. The absence of the Sea Spleenwort, *Asplenium marinum*, from southeast England has not been linked with the prevalence of chalk or clay cliffs in that region. The author most sensibly often refers to Europe in his considerations, and thereby draws attention, for example, to the validity of crediting Dickie's Bladder Fern, *Cystopteris dickieana*, with specific rank. It is perhaps unfortunate that the nomenclature is not completely in line with that of the *Checklist of European Pteridophytes* recently published by Derrick *et al.* (*Sommerfeltia* **6**, 1987) as I am sure that this latest book by Page will have a wide audience on the Continent. The problems of the Scaly Male Ferns, *Dryopteris affinis* agg., remain tangled here, but as this book is a companion to Page's earlier work *The Ferns of Britain and Ireland* (Cambridge University Press, 1982) it is perhaps less confusing if the two accounts tally.

Whilst 'A natural history of Britain's ferns' should not be considered as a beginner's guide to pteridophytes, the copious photographs are so excellent that they will help any novice decipher botanical descriptions. Habitats as well as the individual taxa are illustrated. The author, printer and publisher must all be complimented on the quality of these. I wish, however, that some better compromise had been reached between the presentation of the photographs and captions and the necessity of leaving a quarter of the available text-width blank.

This book should be read by all those interested in Britain's plants, even if they have no predilection for ferns. The lists of associated vascular and cryptogamic plants are, of course, of interest. The most valuable aspect of this work, though, is the way the author has thought about the taxa in conjunction with the habitats. He has really considered what factors of past and present environments are relevant to the pteridophytes of these islands. It is this that I hope will be emulated by all, whether they are enjoying a pleasant botanical stroll or writing such a work on other groups.

With predictions of a dramatic change in climate in the near future, this book has already secured an historical bibliographic place. It is feasible that the distributions of many species will be drastically altered, with the arrival of new taxa from continental Europe. This excellent appraisal of the natural history of Britain's ferns and fern allies can only maintain its already classic status.

J. M. Camus

The Macmillan field guide to British wildflowers. F. Perring & S. M. Walters. Photographs by A. N. Gagg. Pp xxx+226, 110 pp. of colour plates and some line drawings. Macmillan, London. 1989. Price £9.95 (ISBN 0–333–44522–8).

For B.S.B.I. members the most useful feature of this book is likely to be the descriptions of about 800 British wildflowers, excluding trees, shrubs, grasses, sedges, rushes and ferns. (The precise number is unclear, given as 700 on the back cover, 800 on the front cover and nowhere in the main text. The coverage is good, but it is frustrating not to have a clearer idea of the extent of the omissions.) The excellent short descriptions of each species are written in clear readable English, without abbreviations, and with helpful distinguishing features given in bold type.

The illustrations, of practically every plant featured in the book, are photographs, taken in the field to provide an indication of habit, habitat and diagnostic features. It is a great pity that the reproduction is sometimes very poor, giving either a very blurred picture or false colours. But some do show diagnostic features remarkably clearly or give a good indication of habit and they are supplemented by a few excellent line drawings. The layout with photographs and descriptions occupying the same relative positions on facing pages is a joy to use.

Perhaps the most novel feature is the main key, which begins in the endpapers. Here a table with illustrations enables the reader, by choosing the correct column (flower colour) and row (number of petals and the symmetry or shape of the flower) quickly and painlessly to select one of 53 groups. From here the reader turns to one of 19 pages of text, where a further brief selection, based mostly

on leaf shapes and arrangements, leads to a small number of pages in the main descriptive text. These keys will certainly be of great help to the beginner in indicating how to make a start at identifying an unknown flower. It is unfortunate that the explanation of how to use the table interchanges rows and columns. I would quibble with some of the flowers chosen to illustrate flower types and wonder whether all species can be keyed out in this way, but by and large I think this is a most promising way to ease the process of identification.

Apart from the annoying inadequacies of the photographic reproductions this compact hardback book is attractively produced at a very reasonable price of £9.95. The authors are to be congratulated on their efforts to help anyone, novice or expert, to identify any wildflower likely to be found in Britain.

J. M. Newton

The northwest European pollen flora, Vol. 5. Edited by W. Punt, S. Blackmore & G. C. S. Clarke. Pp. 154. Elsevier, Amsterdam. 1988. Price £44.20 (ISBN 0–444–87268–X).

This flora provides systematic and well-illustrated accounts of spore and pollen taxa by family, volume 5 covering Lycopodiaceae, Eriocaulaceae, Tiliaceae, Malvaceae, Verbenaceae and Polygonaceae. For each family there is an introduction outlining the Quaternary occurrences of the pollen taxa, keys for distinguishing them, and detailed descriptions and illustrations of each. The SEMs are visually pleasing and, as far as the structure of the pollen grain is concerned, informative, although the photomicrographs are more useful for identification purposes.

It must be said that this is not a book for the beginner because unless one knows the family or lower taxonomic unit to which a particular fossil pollen grain or spore belongs, the keys cannot be used for identifying it. The illustrations are best used in conjunction with more comprehensive pollen and spore keys such as those of Faegri & Iversen's *Textbook of pollen analysis* (1975) or Moore & Webb's *Illustrated guide to pollen analysis* (1978).

That said, the account of the Lycopodiaceae will prove useful for identifying fossil spores of the family as will that of the Polygonaceae for grains, it being a family with many commonly occurring pollen taxa including the difficult *Rumex acetosa* group. The account of the Tiliaceae with its two pollen taxa will be welcome for its critical treatment of the pollen of *T.* × *vulgaris* Hayne and although the Verbenaceae and Eriocaulaceae each contain only one pollen taxon the descriptions and illustrations are worth having.

The book is pleasingly produced and together with Volumes 1–4, provides a most valuable set of good quality photomicrographs for the palynologist.

J. Turner

Flowering plants of Seychelles. S. A. Robertson. Pp. 327+53 pp. of line drawings & 2 maps. Royal Botanic Gardens, Kew. 1989. Price £12 (ISBN 0–947683–14–1).

This annotated checklist, with line drawings four to a page, was produced by Ann Robertson who spent six years in Seychelles accompanying her entomologist husband on his mission against the coconut beetle. Plans to publish the book in 1982 were not fulfilled, and it has now been published in 1989 with a short list of additions and nomenclatural corrections.

Botanical literature on these Indian Ocean islands has not been easy to assemble in past years, so this new checklist will be invaluable for anyone planning to visit Seychelles. The list is not restricted to indigenous species, but includes also crop plants, weeds and ornamentals; this is particularly useful, as the introduced species now far outnumber the indigenous ones.

The Robertsons were able to visit large numbers of islands through their work on the beetles: 24 of the granitic islands, and 20 of the coral islands. These localities are recorded in the text so that the island source of the records can be identified. Approximately 1140 species are listed, with descriptive notes to help with identification. This is not yet complete, as *Cynorkis kirkii* (recorded in 1985 on Mahé) is not listed – there is always the possibility of finding something new. For short visits

there is possibly still a call for a smaller list from the dozen or so islands mainly visited on a botanical holiday, but meanwhile this publication is a very welcome and useful addition to the available literature.

M. Briggs

Honey identification. R. Sawyer (edited by Professor R. S. Pickard. Bee Research Unit, University College Cardiff). Pp. 115; 7 figures, 125 plates. Cardiff Academic Press, Cyncoed. 1988. Price £15 (ISBN 1–871254–0–0).

Melissopalynology, the study of pollen grains in honey, is the best way of identifying the plants which yield the nectar and honeydew from which honey is derived. Rex Sawyer's book summarises methods of pollen identification and describes the characteristics of honeys from different plant sources and different geographical regions of the world. It also contains chapters on honey certification and techniques for producing reference slides. A quarter of the book consists of photographs of pollen grains prepared by centrifugation and mounting in glycerine jelly. Because this technique produces whole grains, rather than acetolysed samples, the results are different from those obtained by pollen analysis of peat. The book will be of value to beekeepers and all those who need to determine the botanical origins of honey. Botanists with an interest in palynology will also find the tabular keys and illustrations useful.

J. R. Edmondson

Plant taxonomy and biosystematics. Second edition. Clive A. Stace. Pp. viii + 264, with 77 text figures, tables, and b/w photographs, and an appendix. Edward Arnold, London. 1989. Price £30 boards (ISBN 0–7131–2980–8); £14.95 paper (ISBN 0–7131–2955–7).

In reviewing a second edition of a successful textbook, it is appropriate to concentrate on the new features that characterise this edition and distinguish it from its predecessor. It is sufficient to say that the structure of this book remains the same as that of the previous edition, with the same ten chapter titles, arranged in three sections: The Basis of Plant Taxonomy; Sources of Taxonomic Information; and Taxonomy in Practice. Although the author has "tried to update all the . . . chapters and the References", only half accommodate extra material, and only two new chapter components have been introduced: one in chapter 2 (Development of Plant Taxonomy) on "Modern phylogenetic methods (cladistics)", and one in Chapter 7 (Information from Plant Geography and Ecology) on "Vicariance biogeography".

As these new titles suggest, one of the main changes in this edition is to introduce discussion of cladistics and to describe cladistic methodologies. These are done concisely and accurately, with adequate reference to published texts and reviews which deal with the field in greater depth – and also, often, greater bias. In this context Professor Stace's prefatory comments are worth quoting: "I am strongly *for* a close examination of the principles and methods of cladistics in order to find how the subject can most profitably be absorbed into taxonomic practice (with the expectation that it has much to offer), but strongly *against* acceptance of the frequently stated dogmatic views that it is always the best or is the only worthwhile line of phylogenetic investigation, or that phylogenetic classifications are *necessarily* better (more natural or predictive) than phenetic ones".

Although not reflected in the table of contents, the other major revision in this edition is in introducing material on the utilisation of molecular biology techniques in systematics. The discussion of the use of restriction enzymes in DNA studies is necessarily brief but does ensure that the student is aware that there are developments in this area that are of importance in plant systematics. Examples of applications are noted. Indeed one of the major changes in this edition is the greatly increased number of references provided: 490 as against 381 in the first edition.

One of the more striking changes is in format. The first edition appeared only as a paperback 'pocket book'; the new edition has acquired a more spacious layout, with a page size of 23·5 × 15 cm, and production both in boards and paperback. How durable the hardback version will prove is,

however, another matter; the casing of my review copy is already creaking after only a few trips in my briefcase!

In summary, the changes that have been introduced in this new edition make it an even more suitable textbook for any basic University course in plant taxonomy. Although its examples do draw heavily on the European flora, it is international in scope and will be a valuable text not only in the British Isles, but also in other English-speaking countries.

J. McNeill

A revision of the tribe Antirrhineae. D. A. Sutton. Pp. vi+575, with 133 figures and four microfiches. British Museum (Natural History) & Oxford University Press, London & Oxford. 1988. Price £65 (ISBN 0–19–858520–9).

This volume describes and keys out 27 genera and 328 species of the tribe Antirrhineae (Scrophulariaceae). The genera range from the monotypic *Asarina* to *Linaria*, which comprises nearly half the species in the tribe. Revisions of this scope are all too uncommon and, as such, this is a work of major importance. The accounts are prefaced by introductory chapters on the historical background and a review of the characters of taxonomic significance, chief among which are those pertaining to the seed, on which the classification presented here largely rests. The work is, in fact, profusely illustrated with usually first-class scanning electron micrographs of seed surfaces.

The format throughout is that of a conventional monograph, except that synonymies are not given in the text but are relegated to a microfiche (along with the bibliography, lists of specimens and a second index). The text index, however, includes synonyms, but irritatingly refers the reader to the microfiche; I wish it could also have indicated the accepted name to which they belong, in the style of *Flora Europaea*, thus saving the reader a trip to a microfiche-projector. This annoyance aside, the book is well-produced and a mine of painstakingly researched information.

R. J. Gornall

A New Herball. W. Turner. Edited by G. T. L. Chapman & M. N. Tweddle. Pp. 325. The Mid Northumberland Arts Group and Carcanel Press, Morpeth. 1989. Price £30 (ISBN 0–85635–829–0).

A notable trend in postwar publishing has been facsimile reproductions of out of print classics and standard texts, especially in the field of natural history. Some years ago a facsimile was published of John Gerard's much-loved *Herball* of 1597 and now at last we have a reprinting of the first part of the Rev. William Turner's *A New Herball*, a seminal work in the progression of English botany. It is a book of great rarity since many copies were deliberately destroyed during the lifetime of the author whose uncompromising Protestant beliefs and outspoken opinions forced him to seek sanctuary on the continent. The first herbal printed in England was Richard Banckes's small quarto of 1525, probably a copy of some medieval manuscript; the *Grete Herball* (1526) was a translation of the French *Le Grand Herbier*; Turner's work enjoys the distinction of being the first serious account of medicinal plants and their uses to be printed in English.

William Turner, born at Morpeth in Northumberland about 1508, studied divinity and science at Cambridge, was briefly imprisoned during the reign of Henry VIII, became a religious fugitive when Mary was on the throne, and was suspended for nonconformity for a while during Elizabeth's reign. Exile provided him with the opportunity to meet prominent botanists in Italy, Switzerland and Germany who, no doubt, inspired him with the desire to compile a herbal. He returned to England on the accession of Edward VI in 1547, securing the post of physician at Syon House to the Duke of Somerset, the Lord Protector, to whom he dedicated the first instalment of his *Herball*. This was published in 1551, the year in which he was elevated to the deanship of Wells.

A New Herball was, in some respects, the culmination of two earlier works, his *Libellus de Re Herbaria Novus* (1538), the first book to give localities of native British plants, and *The Names of Herbes in Greke, Latin, Englishe, Duche & Frenche* (1548) in which he had announced his intention to write a Latin herbal. In the event he chose English rather than Latin in order to give his work a

wider currency among surgeons and apothecaries. He quoted extensively from Theophrastus, Dioscorides, Galen and Pliny, questioning their authority whenever he disagreed. He ridiculed some of the more dubious legends that had become hallowed in plant lore. He occasionally cited plant localities for those parts of the country he knew well – Northumberland, East Anglia and the environs of London, for instance. Where there was no English name for a plant, he never hesitated to provide one, often translating from a Latin source. *A New Herball* is essentially a manual for the medical profession dispensing comprehensive remedies with a naïve optimism that characterized this genre of writing. Occasionally he fails to resist the urge to moralize: he approved of birch rods "for beating of stubborn boys, that either lie or will not learn" and denounced women who dyed their hair with the "juice" of marigolds, "not being content with the natural colour which God hath given them". Parts 2 and 3 of the *Herball* were published in Cologne in 1562 and 1568 and the entire work provides the first descriptions of some 300 native species, making Turner a pioneer field naturalist.

The joint editors of this facsimile, rightly concerned that the man who has been called the 'Father of English botany' should be honoured in his own county, are to be congratulated on this initiative sponsored by the Mid Northumberland Arts Group. The original black letter script, such a strain on today's eyes, is complemented by a modern transcript and wherever possible current plant names are added. It is regrettable that Turner used the inferior engravings in the octavo edition of Leonard Fuchs's *De Historia Stirpium* (1545) rather than the elegant plates in the earlier quarto edition. They are mean examples of the wood engraver's craft and sit rather uneasily on the page, their impact diminished by the surrounding density of Gothic type. This facsimile has been printed on a pleasant cream paper, with generous margins, and bound in stout boards, making it a pleasure to own as well as to consult.

R. Desmond

Biological collections UK. A report on the findings of the Museums Association Working Party on natural science collections based on a study of biological collections in the United Kingdom. Pp. 588. Museums Association, London. 1987. Price £70 (ISBN 0–902102–64–8).

The impulse to set up the working party responsible for this report was a similar examination of geological collections by P. S. Doughty in 1981, which revealed an appalling state of neglect. In 1983 the working party appointed Bernice Williams as investigator. An extensive questionnaire was sent to 672 institutions in winter and spring 1983–84. The publication reviewed consists largely of Dr Williams's analysis and commentary of the 604 replies (a remarkable response rate), which in some cases were supplemented by a site visit. It is no fault of hers that it is full of typing errors and needs an index.

Biological collections in British (not national) museums are said to be in a sorry state. The staff of most museums lack in various proportions numbers, qualifications, space, daylight, library materials, equipment and managerial and administrative support, all resources costing money, with the result that collections and their supporting documentation deteriorate and type specimens are lost. The recommendations made are not related to the analysis, but the links are obvious enough: Area Museum councils should have peripatetic curators on short-term contracts, funded nationally, who would be based at major museums regionally, to which they could if necessary transfer collections from other institutions which they found unable to afford them proper facilities. Regional laboratories for the conservation of biological material, not necessarily on the same site as the major museums, and a steering group which would provide continuity of planning are other recommendations.

The common sense of these proposals is incontestable, but they do not deal with the whole problem. The distribution of natural history collections is not rational but reflects the history of the establishment of their institutions, often by private benefaction in the 19th century. The continued funding of most of those to which Dr Williams's sternest and most just criticisms are directed is by local authorities, who cannot be expected to share her view that the primary purpose of their museums is the conduct of taxonomic research. Scientific publications by staff are not likely to be regarded by councillors as an adequate return for the expenditure on museums, whereas displays

can be related to authorities' educative function, and biological recording activities show a healthy level of communication between council employees and rate-payers. Responses to the questionnaire show that herbarium material is unpopular for display, so it matters little to us that some museums "display material without themselves having the specialist knowledge necessary to safeguard specimens and without consulting specialists". With so many B.S.B.I. vice-county recorders based in local museums, Dr Williams's views on museums as biological records centres are more important. An authority which advertised for a person to work on records when a curatorial post and a technical post were frozen and three quarters of its collections were in indifferent or even bad order had its priorities "badly awry". In her statistical analysis of responses, she noted a strong negative correlation between emphasis on biological recording and the more traditional activities of research, curation of collections, acquisition and documentation of specimens and visits by outside specialists. The deposit of voucher specimens testifying to the accuracy of determination of the plants and animals recorded should be an essential ingredient of local museum-based recording schemes, but too often the museum is in no fit state to receive them.

R. M. Burton

Obituaries

OLIVER BUCKLE
(1903—1989)

Oliver Buckle, who died in Worthing, Sussex, on 24th February 1989, had devoted a considerable part of his life to botany. Born in 1903, he inherited a love of plants from his father, who showed him flowers on country walks when he was very young. He was educated at Rutlish School, from where he chose banking as his profession. He was with the Midland Bank for 45 years and Manager for 17 of these. After a few years in Somerset he lived in Worthing, Sussex, and from there he built up a comprehensive and detailed knowledge of the Sussex flora, and was possibly unsurpassed in his knowledge of Sussex plant localities. He was B.S.B.I. Recorder for West Sussex (v.c. 13) for some years.

Particularly skilled in field identification, and always ready to share his knowledge, Oliver Buckle was a legendary teacher of field botany in the county, and many botanists who are currently recording in Sussex and beyond (including the writer of this obituary) owe much of their interest and competence to Oliver's early botanical teaching. His practical tips on field identification were linked with a wealth of background information on the distribution, uses and legends associated with each plant.

An enthusiast for the Adult Education movement, Oliver organised series of courses of botanical lectures and field meetings for local branches of W.E.A., Extra Mural classes and village groups around Sussex for nearly 50 years; and in the 25 years since his retirement he was lecturing 200 times each year to groups of all ages and all levels of botanical experience. A close companion of the late Cecil T. Prime, Oliver Buckle collaborated with him in the field studies of the British *Arum* species which led to the publication of the New Naturalist monograph *Lords and Ladies* (Prime 1960). In this, as one of "The Rare Relative" chapter headings the quote "My own particular lunacy" is attributed to O. Buckle. This interest in the genus *Arum* led to many years of travel together in Europe, searching for new species and the elucidation of their taxonomy. One of these expeditions, to Corsica to find *Arum pictum*, was written up in *The Times* in 1963, under the heading "Bunburying in the Scented Isle". Three scientific papers on *Arum* were written in collaboration with C. T. Prime: on *A. italicum* (*Bull. Soc. Sci. Bretagne* **39**: 53–62, 1964); on *A. pictum* (*ibid.* **44**: 83–96, 1969); and on *A. nigrum* (*Arh. Biol. nauka, Beograd* **24**: 45–51, 1972). Interested too in alpine plants, in 1962 Oliver survived a horrific fall in the Alps – a cautionary tale for all interested in mountain plants, as, bending to take a closer look, he slid on slippery grass to fall some 600 m. In spite of broken bones, he was after a few days in hospital able to fly home, and from his stretcher he recorded *Erigeron mucronatus* DC. at Milan Airport.

Apart from supporting his wife, Trudy, in her great interests of music and The Save The Children Fund, Oliver was described in his retirement as "totally occupied all the year round as a naturalist with heavy emphasis on the botanical side". Kindly to all, he will be sadly missed by Sussex botanists, and we extend our sympathy to his wife, two daughters, grandchild and two greatgrandchildren.

M. Briggs

GEORGE A. NELSON
(1903—1989)

George Nelson, M.Sc., Ph.D., was born at Pocklington, East Yorkshire, and died in hospital at Harrogate, aged 85. As a young boy he spent five years as a scholar at Durham Cathedral Choir School before completing his education at Pocklington School. He was apprenticed to a Pocklington

pharmacist after leaving school, and in 1928 became a lecturer at the Leeds College of Pharmacy. His early experiences at Durham and as a student of pharmacy gave him an appreciation and delight in music and an enthusiasm for plants which both remained enduring interests for the rest of his life. When the College of Pharmacy closed in 1935 George Nelson opened a retail pharmacy shop in Leeds, but in 1947 he gave up the shop to accept an appointment as lecturer in pharmacognosy in the Pharmacology Department of the Leeds University Medical Faculty. Whilst serving in the Department he took the degrees of M.Sc. and Ph.D. and he remained in the Department until his retirement in 1969.

Soon after his arrival in Leeds, Nelson joined the Leeds Naturalists' Club and in 1931 he became its General Secretary. For 15 years he was a central figure in the meetings, field excursions and all the activities of the Club. It was at this time that I became friendly with George Nelson and for many years he was my most frequent companion on field excursions. His interest and enthusiasm for field botany made him a congenial companion and together we visited and explored many sites of botanical interest in Yorkshire and beyond.

Nelson was a member of the Yorkshire Naturalists' Union for over 50 years, yet he never attended their field meetings or the meetings of the Botanical Section of the Y.N.U. His membership of the B.S.B.I. also extended to over 50 years, but again he never attended any meeting or field excursion of the Society. This reluctance to extend the range of his contacts to more experienced and specialist botanists and the insularity of his botanical activities were no doubt responsible for his never developing a critical interest in any of our more difficult genera, and despite his innumerable field trips he contributed no articles or records to local or national botanical journals.

In the late 1950s Nelson acted as tutor for a weekly course in botany at the Swarthmore Educational Centre in Leeds. This culminated in a number of official outdoor excursions but frequent additional excursions by members of the class followed, and in the succeeding years the continued field activities of the group resulted in an accumulation of records which were assembled and published as "A Flora of Leeds and District" (*Proc. Leeds phil. lit. Soc., Sci. Sect.*, **9**: 113–178, 1963). Although this work was attributed to the students of the course in botany, it was assembled and edited by George Nelson and was his only published work on floristic botany. By this time his attachment to his Swarthmore group had largely replaced his other alliances. My own excursions with him had long since come to an end and he was now an infrequent attender at meetings of the Leeds Naturalists' Club. And, sadly, an accident to his wife who became crippled so affected his domestic responsibilities that botanical activities were drastically curtailed and finally abandoned. His wife predeceased him and he is survived by an only son to whom our sympathies are extended.

W. A. Sledge

ERIC LISTER SWANN
(1904—1989)

With the passing of Eric Swann, a great era of West Norfolk botany has come to an end. For 50 years he was the mainstay of recording in Norfolk, concentrating most of his energies on the western half (v.c. 28) where he had lived all his life.

Eric Swann was born in King's Lynn in 1904 and was educated at King Edward VII Grammar School. Although he spent his working life in Barclays Bank, his heart was always in botany and he declined promotion because it would have meant moving away from the area he loved and knew so well. Yet in spite of his relatively small field, he was in continuous correspondence with botanists all over the country and even farther afield, gaining some local notoriety by receiving regular parcels from Leningrad throughout the period of the 'Cold War'. These contained willow specimens!

I first met Eric in 1958 when I was a keen but very ignorant botanist, and his patience and thoroughness in helping me were exemplary. A friend remembers taking an unusual grass to Eric at the Bank, and at once piles of money were swept aside as they studied the lengths of glumes and lemmas. Others found him less friendly and he certainly didn't suffer fools gladly, but for all who truly wanted to learn, nothing was too much trouble, and his wry sense of humour and pithy comments were valued by those who knew him.

In his own botanical studies he was meticulous not only in identification but also in recording, keeping notebooks filled with descriptions and comparisons and illustrated with more than competent line drawings of important details. His herbarium filled many filing cabinets and this, together with his moss collection, he has left to the Castle Museum at Norwich (**NWH**).

With his great local knowledge it was inevitable that his thoughts should turn to a Flora, and *West Norfolk plants today* was published as a supplement to *B.S.B.I. Proceedings* in 1962. In 1968, with the co-operation of the late Dr C. P. Petch, he produced the first *Flora of Norfolk* for 50 years, a work which brought him many plaudits. A supplement followed in 1975. His other publications include one on West Norfolk willows, and he also devoted much energy to the study of bryophytes. He was elected a Fellow of the Linnean Society of London, in 1972.

Not surprisingly, Eric was honoured by local societies, being elected President of the Norfolk and Norwich Naturalists' Society and the Heacham and West Norfolk Naturalists' Society, but his proudest moments were in the two years from 1975 to 1977 when he served as President of the B.S.B.I., having been the Society's Treasurer in the 1950s.

With failing health and the deaths of many of his colleagues and correspondents, he had little contact with the botanical world for the last five years of his life, but having committed all his plant records and discoveries to his card-index and files, his knowledge will be there for future generations of botanists to use.

He leaves a widow, Marjorie, who supported him in all his enterprises.

G. Beckett

ARTHUR EDWARD WADE
(1895—1989)

Arthur Edward Wade, M.Sc., F.L.S., died on 20 April 1989 in New Zealand, aged 93, and with his passing Wales lost one of her foremost and best-loved botanists.

Born in Leicester in 1895, Arthur joined the staff of the National Museum of Wales in 1920 as Assistant in the Botany Department. He had been forced to abandon a career as a type-setter by a wound sustained to his right elbow whilst on active service in France in 1917. For nearly 42 years he devoted himself to the study of plants and in 1942 he was appointed Assistant Keeper of Botany. The Welsh National Herbarium (**NMW**), which contained approximately 5,000 specimens when he arrived in Cardiff, grew rapidly and had grown to 197,000 by his retirement in 1961.

From boyhood Arthur had developed a great love of natural history. Now in a more specialized branch, his expertise on flowering plants, ferns, mosses, liverworts and lichens blossomed and he became a leading authority on *Myosotis*, *Symphytum* and the lichen genus *Caloplaca*. He was author, or co-author, of many botanical papers, but he will perhaps be best remembered for three books published by the National Museum of Wales. Two of them were written with his colleague of almost 40 years, the then Keeper of Botany, H. A. Hyde: *Welsh Flowering Plants* (1934) and *Welsh Ferns* (1940), each of them reaching several editions. Wade's third book, *Flora of Monmouthshire* (1970), was all his own work and the fieldwork on which much of it is based was carried out, usually in his own spare time at weekends, over a period of 50 years.

He joined the Botanical Society of the British Isles (then the Botanical Society and Exchange Club of the British Isles) in 1915 and was for several years its longest standing member. When the Vice-county Recorder system was established in the 1940s, he became Recorder for all the Welsh vice-counties until, gradually, resident recorders were found (a process that was not completed until the 1970s!). During the *Atlas* mapping in the 1950s, he vetted every Welsh field record-card and identified thousands of specimens for members; he also acted as Referee for the genera *Myosotis* and *Symphytum* until his retirement.

In 1958, for his services to Botany, he received the honorary degree of Master of Science from the University of Wales, and in 1962 was made an honorary member of the B.S.B.I. He was one of the founder members of the British Lichen Society in 1958, and served as its first Secretary and later its President. In 1977 he was further honoured by the British Lichen Society producing a commemorative issue of the *Lichenologist* for his 80th birthday; in this a new lichen genus, *Wadea*, was described in his honour.

He was an accomplished artist, especially in water-colours, and he used his botanical knowledge and keen eyes in his skilful landscapes to depict trees that are instantly recognisable as oaks, elms or other species. He became President of the South Wales Art Society and was a regular contributor to the annual exhibition of the society from 1927 to 1961; he was also a founder member of the South Wales Group of Artists. His artistic abilities expressed themselves in his work in the Museum galleries, which quickly gained a reputation for excellence, and in his interest in botanical illustration.

After his retirement he continued to spend much of his time in the Botany Department of the National Museum of Wales, becoming an Honorary Research Worker there. He published more of his research on lichens, and saw his *Flora of Monmouthshire* through the press.

He then turned his attention to Glamorgan, where, with several others, he started recording the distribution of plants for a new *Flora*. He continued this work for eleven years and completed a preliminary draft of the text for those families he had been allocated. In 1981, after the death of his son, William, he emigrated to New Zealand to be with his daughter, Vera.

Unfortunately Arthur did not live to see his last work in print. The *Flora of Glamorgan* will be published in 1990 and should be a fitting tribute to the memory of this gifted and talented man.

R. G. Ellis & A. R. Perry

Watsonia, **18**, 115–117 (1990)

Report

ANNUAL GENERAL MEETING, 6 May 1989

The Annual General Meeting of the Society was held at 11.35 hrs in the Department of Animal and Plant Sciences, The University of Sheffield, by kind permission of Professor Lewis. 97 members were present and Dr A. J. Richards, Vice-President, opened the meeting in the Chair. Apologies for absence were read, including apologies from Professor C. A. Stace, retiring President, unable to attend as he was temporarily incapacitated by injury. Minutes of the 1988 Annual General Meeting as published in *Watsonia* **17**: 382–383 (1989), were approved and signed by the Chairman.

REPORT OF COUNCIL

The adoption of the Report, as circulated to members, was proposed by Mr B. A. Gale, seconded by Dr F. H. Perring, and unanimously approved.

TREASURER'S REPORT AND ACCOUNTS

The Treasurer, proposing the adoption of his Report and Accounts, offered to clarify any points, but there were no queries. The adoption of the Report was seconded by Mr S. Beesley and passed unanimously.

ELECTION OF PRESIDENT (1989–1991)

Dr Richards, from the Chair, then introduced the nominated President, Professor D. A. Webb, Sc.D., F.M.L.S., as a scholar, savant with Irish wit, and an exceedingly accomplished botanist with three particular qualifications for this Office: as one of the founding fathers of *Flora Europaea*; the pivot and major author of Irish Floras for half a century; and for his studies on *Saxifraga*. Professor Webb was elected with applause, and taking the Chair thanked Dr Richards and the Society for the nomination, mentioning with humour three disqualifications related to his age and Irish status. As President, Professor Webb expressed the thanks of the Society to Professor C. A. Stace for his term as President. He had given serious consideration to B.S.B.I. affairs, and competently steered through problems which could affect the Society in years ahead.

ELECTION OF VICE-PRESIDENT

Proposing Mr J. Ounsted, M.A., Dr Richards highlighted his 42 years of B.S.B.I. membership in which as a teacher Mr Ounsted had enthused many young people for botany, recalling that he himself had been influenced at school by Mr Ounsted, as had other botanists who are now B.S.B.I. members. As a member of the B.S.B.I.'s Meetings Committee, through the years Mr Ounsted had organised many field meetings, both general and for juniors, overseas and in Britain. He was unanimously elected as a Vice-President.

RE-ELECTION OF HONORARY GENERAL SECRETARY AND HONORARY TREASURER

The President from the Chair proposed the re-election of these Officers, warmly thanking them for their major roles in the running of the Society, carried out with humour, wisdom and experience. Their re-election was carried by the meeting with applause.

ELECTION OF COUNCIL MEMBERS

In accordance with Rule 10, nominations had been received for Mr C. R. Boon, B.Sc., Mr R. M. Burton, F.L.S. and Mrs I. P. Weston, B.Sc. They were elected unanimously.

ELECTION OF HONORARY MEMBERS

Introducing the nomination of Miss M. P. H. Kertland, M.Sc., Mr S. Beesley described the help and support given to botanists in Ireland, for field botany in particular, and recalled that Miss Kertland was Editor of the *Irish Naturalists' Journal* for 25 years. Her election as Honorary Member was carried by the meeting with applause.

RE-ELECTION OF HONORARY AUDITORS

The Chairman proposed the re-election of Grant Thornton, West Walk, Leicester, as Honorary Auditors, and the Treasurer reminded members that the Society was fortunate to have a firm of international standing named below our Annual Accounts.

ANY OTHER BUSINESS

The President recorded thanks to the secretaries of the Permanent Working Committees and all the Editors of the Society's Journals, reminding the Society that, following a recent change in Rules, these Secretaries and Editors were no longer elected by this meeting, but were now appointed by Council. Their considerable work for the Society was very much appreciated, and this was supported with general applause. Mr R. G. Ellis sadly reported the death of Mr A. E. Wade who, having joined in 1915, was the longest standing member of this Society. His contribution to the study of Welsh plants had been invaluable, and he was for many years the Chairman of the B.S.B.I. Committee for Wales. After retirement, he had made his home in New Zealand. The President expressed the thanks of all present to Dr T. T. Elkington for his excellent organisation of the programme for this meeting.

The meeting closed at 12.15 hrs.

M. Briggs

PAPERS READ AT THE ANNUAL GENERAL MEETING

PLANTS OF METALLIFEROUS MINE WORKINGS IN THE BRITISH ISLES

Old metalliferous mine workings, such as derelict lead mines, support a limited but distinctive flora, the composition of which depends on many factors including the extent of heavy metal contamination, the age of the mine, and the nature of the country rocks. Acidic wastes such as those in central and western Wales, are very species-poor, whereas the older sites on the Carboniferous limestone of the Pennines can be floristically rich, with many typical limestone grassland species present as metal-tolerant races.

The paper presented a review of metallophyte vegetation in the British Isles based on a classification of species showing particular association with metalliferous (lead, zinc, copper and cadmium contaminated) soils. The distribution of *absolute* and *local* metallophytes was considered using as examples, *Thlaspi caerulescens*, *Minuartia verna*, *Viola lutea*, *Silene vulgaris* subsp. *maritima*, *Armeria maritima* and *Cochlearia pyrenaica*. Other 'rare' colonists of lead-mine spoils in the Pennines were described, particularly those that were going to be encountered on the field excursion.

The paper provided an evolutionary perspective on the nature of plant adaptation to the extreme soil conditions typical of old metalliferous mine workings.

A. J. M. Baker

THE VEGETATION OF THE RIVER DON, SHEFFIELD

The River Don forms a mixed habitat corridor running for 16 km through Sheffield. A particularly varied vegetation is associated with weirs, where plant communities have developed with a high proportion of introduced species. In many places the banks of the river are dominated by *Reynoutria japonica* and *Impatiens glandulifera*, which were not present 20 years ago. They have replaced more species-rich native communities known to have existed in the past. Stands of *R. japonica* frequently support a ground flora more typical of the vernal phase of oak woodland – *Hyacinthoides non-scripta*, *Ranunculus ficaria*, *Allium ursinum*, *Anemone nemorosa* and *Lamiastrum galeobdolon*.

Present levels of water pollution are depressing the aquatic vegetation; *Potamogeton pectinatus* is the main channel dominant. Thirty-five well-grown fig trees (*Ficus carica*) are believed to have originated from seeds distributed in sewage, their establishment being favoured by the heated water discharged from steel foundries.

Currently the vegetation along the river is in an unusually dynamic state due to changing land-use, the spread of aggressive weeds and ameliorating pollution.

O. L. Gilbert

In addition to the above, Dr D. B. Wheeler read a paper entitled *The reasons for rarity of rich fen plants: management conditions or environmental circumstance?*

FIELD EXCURSION HELD IN CONJUNCTION WITH THE A.G.M.

ROSE END MEADOWS NATURE RESERVE, DERBYSHIRE. 7 MAY 1989

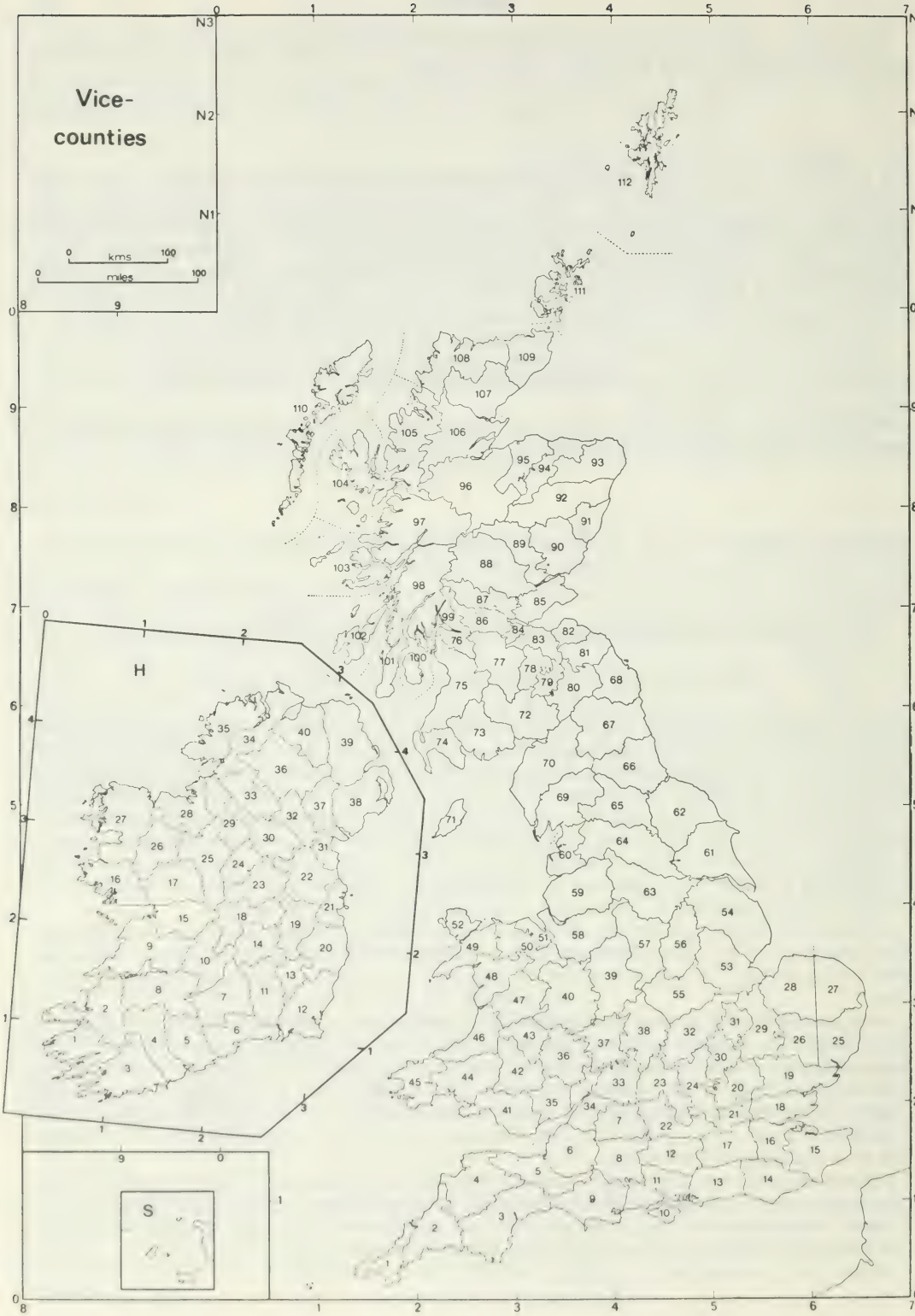
Some 70 members and guests assembled in Cromford on a beautiful morning and walked to the entrance of the reserve. Rose End Meadows is an area of almost 7 ha, forming a patchwork of old fields on the Carboniferous limestone. The reserve was bought at auction by the Derbyshire Wildlife Trust following the death of the former owner. The Trust has continued the previous management of hay-making and grazing to maintain the floristic diversity. This diversity was obvious from the moment that we entered, and it soon became evident that the photographers would be busy because the fields were dominated by *Hyacinthoides non-scripta* and *Primula veris* in flower. Closer investigation revealed large patches of *Ophioglossum vulgatum* and plenty of indicators of unimproved grassland such as *Rhinanthus minor* and *Sanguisorba officinalis*.

A feature of the reserve is the large number of old lead mine spoil-heaps and shafts dating from at least as far back as the 1700s. The heaps vary in the degree of colonization, but showed abundant *Minuartia verna* and *Thlaspi caerulescens* (*T. alpestre*); one patch of *Botrychium lunaria* was also seen.

After lunch the party moved on to examine an extensive area of old lead workings nearby, near Winksworth. The intricate mosaic of vegetation associated with these workings provoked much discussion from ecologically-minded members, and all of us admired the fine show of *Viola lutea* in a range of colour variants. The scenery of this part of the Peak District is also superb and was much admired and photographed. At the end of the afternoon a few members walked along the disused High Peak Railway, now a public foot and bridle path, to visit Black Rocks, an outcrop of Millstone Grit with adjoining lead workings.

I should like to express my thanks to all those who helped to make the weekend a success: to the speakers for their excellent, well-illustrated lectures; Mrs E. Thorpe, Dr A. J. M. Baker and Dr A. Willmot, who guided the party around Rose End and answered the many queries; and to the Derbyshire Wildlife Trust for permission to visit the Rose End reserve.

T. T. Elkington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NAMES OF VICE-COUNTIES IN *WATSONIA*

ENGLAND, WALES AND SCOTLAND

1. W. Cornwall
1b. Scilly
2. E. Cornwall
3. S. Devon
4. N. Devon
5. S. Somerset
6. N. Somerset
7. N. Wilts.
8. S. Wilts.
9. Dorset
10. Wight
11. S. Hants.
12. N. Hants.
13. W. Sussex
14. E. Sussex
15. E. Kent
16. W. Kent
17. Surrey
18. S. Essex
19. N. Essex
20. Herts.
21. Middlesex
22. Berks.
23. Oxon
24. Bucks.
25. E. Suffolk
26. W. Suffolk
27. E. Norfolk
28. W. Norfolk
29. Cambs.
30. Beds.
31. Hunts.
32. Northants.
33. E. Gloucs.
34. W. Gloucs.
35. Mons.
36. Herefs.
37. Worcs.
38. Warks.
39. Staffs.
40. Salop
41. Glam.
42. Brecs.
43. Rads.
44. Carms.
45. Pembs.
46. Cards.
47. Monts.
48. Merioneth
49. Caerns.
50. Denbs.
51. Flints.
52. Anglesey
53. S. Lincs.
54. N. Lincs.
55. Leics.
55b. Rutland
56. Notts.
57. Derbys.
58. Cheshire
59. S. Lancs.
60. W. Lancs.
61. S.E. Yorks.
62. N.E. Yorks.
63. S.W. Yorks.
64. Mid-W. Yorks.
65. N.W. Yorks.
66. Co. Durham
67. S. Northumb.
68. Cheviot
69. Westmorland
69b. Furness
70. Cumberland
71. Man
72. Dumfriess.
73. Kirkcudbrights.
74. Wigtowns.
75. Ayrs.
76. Renfrews.
77. Lanarks.
78. Peebless.
79. Selkirks.
80. Roxburghs.
81. Berwicks.
82. E. Lothian
83. Midlothian
84. W. Lothian
85. Fife
86. Stirlings.
87. W. Perth
88. Mid Perth
89. E. Perth
90. Angus
91. Kincardines.
92. S. Aberdeen
93. N. Aberdeen
94. Banffs.
95. Moray
96. Easterness
96b. Nairns.
97. Westerness
98. Main Argyll
99. Dunbarton
100. Clyde Is.
101. Kintyre
102. S. Ebudes
103. Mid Ebudes
104. N. Ebudes
105. W. Ross
106. E. Ross
107. E. Sutherland
108. W. Sutherland
109. Caithness
110. Outer Hebrides
111. Orkney
112. Shetland

IRELAND

H1. S. Kerry
H2. N. Kerry
H3. W. Cork
H4. Mid Cork
H5. E. Cork
H6. Co. Waterford
H7. S. Tipperary
H8. Co. Limerick
H9. Co. Clare
H10. N. Tipperary
H11. Co. Kilkenny
H12. Co. Wexford
H13. Co. Carlow
H14. Laois
H15. S.E. Galway
H16. W. Galway
H17. N.E. Galway
H18. Offaly
H19. Co. Kildare
H20. Co. Wicklow
H21. Co. Dublin
H22. Meath
H23. Westmeath
H24. Co. Longford
H25. Co. Roscommon
H26. E. Mayo
H27. W. Mayo
H28. Co. Sligo
H29. Co. Leitrim
H30. Co. Cavan
H31. Co. Louth
H32. Co. Monaghan
H33. Fermanagh
H34. E. Donegal
H35. W. Donegal
H36. Tyrone
H37. Co. Armagh
H38. Co. Down
H39. Co. Antrim
H40. Co. Londonderry

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Notes on some *Rosa* taxa recorded as occurring in the British Isles

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ABSTRACT

The authors of accounts of *Rosa* likely to be consulted at present differ in their treatment of the genus both in the number of species recognized and in the names applied to them. An attempt is made to rationalize the treatment of *Rosa* in the British Isles by typification of some of the controversial names and by suggesting which taxa should be given specific rank.

INTRODUCTION

For many years the most widely accepted authority for British roses was Wolley-Dod (1930–31). Wolley-Dod undoubtedly succeeded in making some order out of the chaos which had previously prevailed. However, his system was in many ways unsatisfactory. He never appeared to be really convinced about the great propensity for hybridization in the genus *Rosa*. Because of this he was obliged to consider most of his species as very variable, and to name and describe numerous varieties and forms. Wolley-Dod (1936) himself later expressed doubt as to the significance of these varieties, stating that rarely in the field did one find specimens which corresponded closely or even remotely with the author's description of a named variety.

Warburg (1952) favoured a somewhat different interpretation of species under a slightly different nomenclature. This treatment was closely followed by Dandy (1958). Nevertheless many British rhodologists continued to follow Wolley-Dod's system. Most notable of these was R. Melville, whose researches into the vitamin C content of rose hips during the Second World War led him to take an interest in the genus, and subsequently to become the leading authority on British *Rosa*. He was well aware of the propensity for hybridization in the genus. Melville (1967, 1975) gave excellent accounts of this phenomenon. Nevertheless, though he would confirm a hybrid determination, he continued to use Wolley-Dod varietal names for most specimens sent to him.

The publication of Klášterský's (1968) account of *Rosa* presented a somewhat different species concept and nomenclature. Klášterský gave specific rank to many taxa which are demonstrably hybrids. All the names used by Klášterský for British taxa were adopted by the Biological Records Centre as accepted names in its check list of British vascular plants. Furthermore the Scandinavian rhodologists, notably Malmgren (1986) and Nilsson (1967), favoured yet another interpretation of the genus. Therefore the authors of the present article, when commissioned by the Botanical Society of the British Isles to prepare a handbook of the roses of the British Isles, were faced with considerable taxonomic problems, both in the correct nomenclature and in the number of species which should be recognized. Confronted with the vital necessity of attempting to solve these problems, we undertook research with a view to the typifying of certain names, establishing cases of synonymy and priority, and deciding which taxa were to be accorded specific rank.

Our main source for the preliminary background information was Wolley-Dod (1908, 1910, 1930–31, 1936). Other important literature sources are cited in their appropriate places in the text. For

study of the plants themselves both of us can rely upon considerable experience of British *Rosa* in the field. Also, as B.S.B.I. referees for *Rosa*, we have both received and been able to examine specimens from all over the greater part of the British Isles. Problems of time and distance prevented us from undertaking as much herbarium research as we wished. However, we both spent some days examining Melville's British collection of *Rosa* at **K**, though it was impossible in the time available to do full justice to this vast collection. It is a pity that we were not able to take more than a cursory glance at some of Wolley-Dod's material at **BM**. Most of this is still in the original packages and, as far as we know, has not been examined by anyone since Wolley-Dod. We also examined some important specimens in **LINN**, and obtained on loan material from **LIV** and from some Continental herbaria.

Our conclusions concerning the taxa numbered 9 to 15 in this article are based largely on current British opinion, together with our personal experience of British *Rosa* in the field and in herbaria. Apart from the examination of some of Klášterský's specimens obtained on loan from **PR**, we have not undertaken any extensive research on these taxa. They are included here for the benefit of those who make use of *Flora Europaea* or the Biological Records Centre check list.

NOTES ON SELECTED TAXA

1. **Rosa canina** L., *Sp. Pl.* 491 (1753). LECTOTYPE: Specimen no. 652.31, labelled "canina 4" by Linnaeus (**LINN**), selected here. Seen by us 1989.

This species as at present understood by British rhodologists is very variable. It is difficult to determine from the accounts of Continental authors exactly what is included under this name. Wolley-Dod (1930–31) divided the species into five 'groups', two of which (groups *Andegavenses* and *Scabratae*) are now known to consist of hybrids of *R. canina* with other species. A third group, *Transitoriae*, almost certainly consists of hybrids between groups *Dumales* and *Lutetianae*.

The lectotype specimen of *Rosa canina* corresponds well with the characters of group *Lutetianae* in having uniserrate eglandular leaflets and very few glands on stipules and rachis. Group *Dumales* has glandular-biserrate leaflets and numerous stipitate glands on stipules and rachis. Pending further research, and to facilitate recording that would allow for possible future changes in taxonomic opinion, we propose to retain the informal groups *Lutetianae*, *Transitoriae* and *Dumales*. These groups will serve as convenient and familiar informal interim labels, even though they are not nomenclaturally valid, and the first named group is nomenclaturally typical.

The type specimen is wholly glabrous. In Britain one often finds plants differing from this only in having pubescent leaflets, the pubescence frequently being sparse or confined to midribs and veins beneath. Hitherto some British rhodologists, following Wolley-Dod, have named these plants as *Rosa dumetorum* Thuill. This has been proved inadmissible (cf. *R. dumetorum* below). It is therefore proposed that these pubescent plants should be included in *R. canina*, and, pending further research, recorded as a fourth group, group *Pubescentes*.

2. **Rosa dumetorum** Thuill., *Fl. Environs Paris*, 2nd ed., 250 (1799). LECTOTYPE: specimen collected by Thuillier, ex herb. Delessert, mounted with relevant cutting from the original *Fl. Env. Paris* (**G**), selected here. Seen by us 1989.

The lectotype without doubt consists of a hybrid of *R. canina* and *R. obtusifolia* Desv. So also does most Continental material labelled *R. dumetorum* at **K**, including one specimen labelled by Crépin as having been collected by Thuillier. The original description of *R. dumetorum*, though somewhat inadequate, confirms the determination. The British 'hairy *canina*' hitherto named as *R. dumetorum* does not correspond with Thuillier's material.

As far as we know, *R.* × *dumetorum* is the earliest (and therefore correct) name for the hybrid *R. canina* × *R. obtusifolia*.

3. **Rosa corymbifera** Borkh., *Vers. Forstbot. Beschr. Holzart* 319 (1790). TYPE: unknown (fide *Taxonomic Literature*, 2nd ed., **1**: 280 (1976)).

Specimens from **PR** so determined by Klášterský and seen by us are without doubt the hybrid of *R.*

canina and *R. obtusifolia* with *R. obtusifolia* as the seed parent. Klášterský's (1968) description of *R. corymbifera* in *Flora Europaea*, though somewhat inadequate, also appears to refer to this hybrid. However, Borkhausen's very clear and detailed description cannot possibly be applied to this hybrid. Except for the pronouncedly corymbose inflorescence, which is unusual but not unknown in British material, Borkhausen's description points unequivocally to the pubescent variety of *R. canina* described above, which some British rhodologists have hitherto named as *R. dumetorum* Thuill. It is unfortunate that there is no type specimen. Klášterský's species concept for *Rosa* seems to be largely pragmatic, in that he assigns specific status to several hybrids. We do not know whether he consulted Borkhausen's description, but we cannot see how this description could be interpreted as applying to the specimens which we saw determined by Klášterský as *R. corymbifera*.

We do not think there is any justification for separating from *R. canina*, at species level, plants which differ from it only by the pubescence (often slight) of the leaves. However, if this distinction were to be made, the correct name for the taxon is *R. corymbifera* Borkh.

4. **Rosa caesia** Sm. in Smith & Sowerby, *Engl. Bot.* **33**: t.2367 (1812). LECTOTYPE: Specimen no. 901.25, Smith Herbarium (**LINN**), selected here. Seen by us 1989.

5. **Rosa coriifolia** Fries, *Novit. Fl. Suec.* 33 (1814). HOLOTYPE: **UPS**. Seen by A. L. Primavesi 1987. Examination of the types of these two names, and of Borrer's excellent material of *R. caesia* at **K** (Borrer having provided Smith with the original material of *R. caesia*), convinced us that they represent a single taxon. The same decision was reached by Klášterský (1968). The correct name is therefore *R. caesia*. The taxon is characterised by pubescent, somewhat rugose, non-glaucous leaflets.

6. **Rosa afzeliana** Fries, *Fl. Halland.* 87 (1817). HOLOTYPE: **UPS**. Not seen by us (not available on loan).

Our interpretation of this taxon relies upon that of various Scandinavian authors (e.g. Nilsson 1967; Malmgren 1986), whose accuracy we do not doubt in this matter. It differs from *R. caesia* only in its glabrous, smooth, glaucous leaflets, and possibly in the greater incidence of anthocyanin in the young stems. It also differs somewhat in its geographical and altitudinal distribution. Hence it does not seem reasonable to consider them as separate species, and, in accordance with the views of some Scandinavian rhodologists, we shall treat the two as subspecies of one species.

As far as we are aware the earliest available name at subspecific rank is *Rosa glauca* subsp. *glauca* Nyman, an autonym created by Nyman (1878) when he published *R. glauca* subsp. *venosa* and subsp. *hibernica*. Although Nyman referred *R. glauca* to "Vill. ap. Lois.", that *R. glauca* is a later homonym of *R. glauca* Pourret (1788) and hence is illegitimate. Nevertheless the epithet *glauca* at subspecies level dating from Nyman (1878) is available as a basionym:

Rosa caesia subsp. **glauca** (Nyman) Graham & Primavesi, **comb. nov.**

Rosa glauca subsp. *glauca* Nyman, *Consp. Fl. Europ.* 236 (1878).

7. **Rosa dumalis** Bechst., *Forstbot.* 939 (1810). TYPE: formerly at **B**, destroyed (fide P. Hiepko, in litt. 1989).

This name has been used by various authors to cover *R. caesia* subsp. *glauca* (as *R. dumalis* subsp. *dumalis*), and, if applicable, would certainly pre-date *R. caesia*, *R. coriifolia* and *R. afzeliana*. R. Melville (in litt. 1975) considered this application to be extremely dubious. In order to determine the identity of *R. dumalis* we have only Bechstein's description, which, like many of those of older authors, lacks some essential details. However, in our opinion, corroborated by that of A. O. Chater when we met together and discussed this matter in 1988, the description is of a hybrid between *R. caesia* subsp. *glauca* and *R. canina*. There are enough characters in the lengthy description to justify the consideration that the taxon is this hybrid, and to exclude it from synonymy with *R. caesia* subsp. *glauca*. On the evidence outlined above, the name *R.* × *dumalis* Bechst. should by priority be the correct one for the hybrid *R. caesia* × *R. canina*.

8. **Rosa elliptica** Tausch, *Flora (Regensb.)* **2**: 465 (1819). TYPE: probably **PR** (fide *Taxonomic Literature*, 2nd ed., **6**: 182 (1976). Not seen by us.

Continental specimens obtained on loan from **PR** and so determined by Klášterský represent a distinct species, but we have been unable to find any British or Irish material corresponding to this, and conclude that the species does not occur in the British Isles, despite its inclusion by Warburg (1952) and Dandy (1958). There are no specimens in **OXF** labelled *R. elliptica*. The specimens obtained on loan from there were labelled *Rosa inodora* Fr., which has been considered to be synonymous with *R. elliptica*. However this old material from **OXF** does not resemble the Continental material of *R. elliptica*, and appears to consist of hybrids of *R. agrestis* Savi or of *R. micrantha* Borrer ex Sm.

9. **Rosa squarrosa** (Rau) Boreau, *Fl. Centre Fr.*, 3rd ed., **2**: 222 (1857).

R. canina var. *squarrosa* Rau, *Enumeratio Rosarium circa Wirceburgum et Pagos adjacentes sponte crescentium*, 77 (1816).

Rau's description of *R. canina* var. *squarrosa* corresponds closely with Wolley-Dod's *R. canina* group *Dumales*, in which this variety is included by Wolley-Dod. Boreau's description differs from this in that he describes the petioles as having some hairs, and the sepals as tomentose on the upper surface and the margins (this group of *R. canina* is entirely glabrous). He also says that the styles are hairy, but this could come within the range of variation of *R. canina* as we understand it at present. Klášterský's (1968) description is sparse, but differs from Boreau's in that he states that the styles are long-exserted (Boreau expressly states that they are short), and that they are villous (Boreau's word is "velu"). A specimen from **PR** determined as *R. squarrosa* by Klášterský appears to us to be a hybrid of *R. canina* group *Dumales* and *R. caesia* subsp. *glauca*, which would account for the villous styles; they were not long-exserted. Rau's type material is presumed to have been destroyed, and all we have to go on is his original description. We conclude that pending further research this taxon is best treated as a variety of *R. canina*. If British rhodologists should ever decide to separate the glandular-biserrate varieties from *R. canina* as a species, then *R. squarrosa* appears to be the correct name, provided that there is no earlier name which is applicable.

10. **Rosa andegavensis** Bast., *Essai Fl. Maine Loire* 189 (1809).

Wolley-Dod included this in his group *Andegavenses* as a variety of *R. canina*. British rhodologists now consider group *Andegavenses* to consist of hybrids of *R. canina*, probably in the main with *R. arvensis* Huds. or *R. stylosa* Desv. Klášterský's (1968) description could certainly be applied to the latter hybrid. We did not receive any material of this taxon on loan from Prague.

11. **Rosa nitidula** Besser, *Cat. Pl. Jard. Krzemien., Suppl.* **4**: 20 (1815).

If, as Klášterský (1968) stated, this is synonymous with *R. blondaeana* Ripart ex Deséglise, then Wolley-Dod included it in his group *Scabratae* as a variety of *R. canina*. This group is now considered to consist of hybrids of *R. canina* with species having glandular-hispid pedicels and subfoliar glands. The specimen from **PR** which we examined was in our opinion certainly a hybrid of *R. canina*, probably with *R. rubiginosa* L. Besser's detailed description confirms this view, and indeed Besser himself states that this plant has affinities with the *Rubiginosae*.

12. **Rosa vosagiaca** Desportes, *Ros. Gall.*, 88 (1828).

Klášterský's (1968) description of this corresponds in all respects with a description of *R. caesia* subsp. *glauca*. It would be interesting to know why, in treating this as a separate species, Klášterský did not make use of the earlier name *R. afzeliana* Fr. We did not receive any material of this on loan from **PR**. Klášterský omitted Br from his list of localities. Consequently *R. vosagiaca* (and hence *R. caesia* subsp. *glauca*) is omitted from the Biological Records Centre check-list.

13. **Rosa subcanina** (Christ) Dalla Torre & Sarnth., *Fl. Tirol.* **6(2)**: 515 (1909).
The specimen obtained on loan from **PR** was clearly *R. caesia* subsp. *glauca* × *R. canina*. This hybrid occurs frequently in Britain where the two parents occur together. Wolley-Dod placed it in *R. afzeliana* group *Subcaninae*.

14. **Rosa subcollina** (Christ) Dalla Torre & Sarnth., *Fl. Tirol.* **6(2)**: 516 (1909).
The specimen on loan from **PR** was clearly *R. caesia* subsp. *caesia* × *R. canina*. This hybrid also occurs frequently in Britain in the presence of the two parents. Wolley-Dod placed it in *R. coriifolia* group *Subcollinae*.

15. **Rosa deseglisei** Boreau, *Fl. Centre Fr.*, 3rd ed., **2**: 224 (1857).
We did not receive any material of this on loan from **PR**. Klášterský's (1968) description of *R. deseglisei* would appear to be that of a hybrid of *R. obtusifolia*. Wolley-Dod made it a variety of *R. dumetorum* group *Deseglisei*, a group characterized by having glandular-hispid pedicels but with no subfoliar glands. Melville (1975) considered the British material to be a hybrid between *R. dumetorum* (i.e. pubescent *R. canina*) and *R. arvensis*. From our experience of British material formerly named as *R. dumetorum* var. *deseglisei* we are confident that this consists of hybrids of *R. canina*, probably not first-generation hybrids. We have not seen Boreau's original description. The translation of it given by Wolley-Dod (1908) is somewhat vague and could be applied to any of the above interpretations. Not having seen the type or any Continental material we cannot, of course, be sure that Continental plants are not a distinct species. However, we can say that if it is a distinct species then it does not occur in Britain, because all British material with any of the interpretations mentioned above can be accounted for as hybrids.

16. **Rosa scabriuscula** Sm. in Smith & Sowerby, *Engl. Bot.*, **27**: t.1896 (1808). LECTOTYPE: Specimen 1909. LBG. 7116 (**LIV**), selected here. Seen by A. L. Primavesi 1989.
The specimen selected as lectotype was collected by Smith near Bury St Edmunds, Suffolk, in June 1804. In the Smith Herbarium at **LINN** there is only one specimen suitable for selection as a lectotype. This is on sheet 901.78, which has three different specimens mounted on it: (1) Near Newcastle, Winch, 1804; (2) Near Bury, Smith, 1804; (3) Near Newcastle, Winch, undated. Specimen No. 2 is identical in characters with the specimen at **LIV**, but it is smaller and less easy to examine than the Liverpool specimen. Smith's description mentions both the 1804 collections.

It is obvious from examination of the specimens that those of Winch and Smith are completely different plants. Smith's material is plainly a hybrid of *R. tomentosa*; Winch's is a form of *R. mollis*, most probably with introgression of some other species. Comparison of these specimens with Smith's description in the protologue led us to the conclusion that Smith was at least primarily describing his own material. The leaflets of Smith's specimens, for example, are pubescent on the midribs only, whereas those of Winch are pubescent over the whole lower surface. The young leaves of the dated Winch specimen are densely pubescent on both sides, a condition which Smith does appear to allow for in the protologue, and his own specimens do not show it. It seems to us that Smith was basing his description on his own material, and at the same time endeavouring to reconcile the differences shown by that of Winch. Sowerby's figure does not correspond with any of the specimens, especially in the leaves. The sepals with their large lobes are more like those of Smith's specimens. Wolley-Dod (1910, 1929, 1930, 1930–31) describes the considerable discussion and controversy as to what Sowerby based his figure on. It seems likely that he used material supplied by Winch, collected at a later date than the lectotype, but it has even been suggested that he used the wrong plant for his figure.

Wolley-Dod (1930–31) was also of the opinion that Smith based his description on his own material, stating that Winch distributed and sent to Smith specimens of *R. mollis* from Northumberland to represent Smith's *R. scabriuscula*. Wolley-Dod says: "Smith seems to have suspected some error, but did not fully appreciate it, and incorporated some of these wrongly named specimens with his own specimens and even illustrated one of them, but it is clear from his descriptions that he had quite a different plant in his mind."

Careful examination of the lectotype has convinced us that it is *R. canina* × *R. tomentosa*. It certainly has no affinities with *R. mollis*, and Wolley-Dod (1930–31) concurs with this opinion. In any case this is extremely unlikely in a locality as far south as Bury St Edmunds. Conversely, it is almost equally unlikely that Winch's material could be a *R. tomentosa* hybrid; in the north *R. tomentosa* occurs as single bushes in a few areas only.

In accordance with the conclusions reached above, *R.* × *scabriuscula* Smith is the earliest, and therefore correct, name for the hybrid *R. canina* × *R. tomentosa*.

LIST OF NATIVE SPECIES

In accordance with these conclusions, the following are the species of *Rosa* native to the British Isles:

R. arvensis Huds.
R. pimpinellifolia L.
R. stylosa Desv.
R. canina L.
R. caesia Sm.
  subsp. *caesia*
  subsp. *glauca* (Nyman) Graham & Primavesi
R. obtusifolia Desv.
R. tomentosa Sm.
R. sherardii Davies
R. mollis Sm.
R. rubiginosa L.
R. micrantha Borrer ex Sm.
R. agrestis Savi

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REFERENCES

Dandy, J. E. (1958). *List of British vascular plants*. London.
Klášterský, I. (1968). *Rosa* L., in Tutin, T. G. *et al.*, eds. *Flora Europaea* **2**: 25–32. Cambridge.
Malmgren, U. (1986). Släktet *Rosa* i Sverige. *Svensk bot. Tidskr.* **80**: 209–227.
Melville, R. (1967). The problem of classification in the genus *Rosa*. *Bull. Jard. bot. nat. Belg.* **37**: 39–44.
Melville, R. (1975). *Rosa* L., in Stace, C. A., ed. *Hybridization and the flora of the British Isles*, pp. 212–227. London.
Nilsson, O. (1967). Drawings of Scandinavian plants. *Bot. Notiser* **120**: 1–8, 137–143, 249–254, 393–407.
Warburg, E. F. (1952). *Rosa* L., in Clapham, A. R., Tutin, T. G. & Warburg, E. F. *Flora of the British Isles*, pp. 516–527. Cambridge.
Wolley-Dod, A. H. (1908). The subsection *Eu-caninae* of the genus *Rosa*. *J. Bot., Lond.* **46**, Supplement: 1–110.
Wolley-Dod, A. H. (1910). The British roses (excluding *Eu-caninae*). *J. Bot., Lond.* **48**, Supplement: 1–141.
Wolley-Dod, A. H. (1929). On some varieties of *Rosa tomentosa* (*Scabriusculae*). *J. Bot., Lond.* **67**: 38–42.
Wolley-Dod, A. H. (1930). *Rosa scabriuscula* Smith. *J. Bot., Lond.* **68**: 185–187.
Wolley-Dod, A. H. (1930–31). A revision of the British Roses. *J. Bot., Lond.* **68** & **69**, Supplements.
Wolley-Dod, A. H. (1936). Some rose notes. *Rep. botl Soc. Exch. Club Br. Isl.* **11**: 68–81.

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The lectotypification and revision of Dahlstedt's species of *Taraxacum* Weber based on British or Irish plants

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ABSTRACT

The lectotypification of 62 species of *Taraxacum* Weber (Asteraceae), validly published by H. Dahlstedt from material collected in Great Britain and Ireland earlier this century, has been long outstanding and is prompted by recent advances in our understanding of the genus.

INTRODUCTION

In the British Isles, serious study of the genus *Taraxacum* Weber (Asteraceae) commenced only in the 1920s when the two active botanists G. C. Druce and H. H. Johnston sent substantial numbers of herbarium specimens of *Taraxacum* to the eminent Swedish taraxacologist H. Dahlstedt. In Druce's case the material largely centred on Oxford although it also included material from Ireland, Scotland and Wales. Johnston on the other hand, confined his studies entirely to the Orkneys and Shetlands where, as with other genera, he collected copiously and assiduously.

From this material, ignoring nomina in herbaria and nomina nuda, Dahlstedt validly published 62 species; 19 being from Johnston's submissions. Those sent by Druce were published in the *Reports of the Botanical Society and Exchange Club of the British Isles*. Some of the Johnston species were also published there, but the majority were placed in the *Transactions and Proceedings of the Botanical Society of Edinburgh*. Some were also published by Johnston, seemingly privately, in papers he called *Additions to the Flora of Orkney*. After this valuable incursion, British taraxacology languished, until A. J. Richards revived an interest in the taxonomy, stemming from his more general concern with plant breeding systems, especially apomixis. With the help of some Continental botanists, especially J. L. van Soest he attempted the first comprehensive view of the British and Irish *Taraxacum* flora, culminating in the publication of the *Taraxacum flora of the British Isles* (Richards 1972). In preparing this he had examined many, but by no means all, of the materials under discussion, sometimes choosing 'lectotypes' (mistakenly written as "holotype" on the sheets), though not publishing these. In fact others had examined these sheets from time to time, occasionally annotating them usefully. Van Soest had examined the **OXF** sheets. In the late 1930s, some of the specimens in **S** were examined by the Swedish taraxacologist G. Haglund where, on occasion, he had even chosen lectotypes, though again without publishing these. In 1980 P. D. Sell added some labels to some of the sheets in **OXF** indicating his understanding of their type status.

In the present paper we wish to point out where some of the many problems have been created, both by Dahlstedt's original work and by sporadic attempts to typify and revise the material.

Firstly Dahlstedt only knew our *Taraxacum* flora from the dried specimens submitted to him. He was at a considerable disadvantage in comparing material with species known to him. Nor was he familiar with the range of variation of the species collected. In some cases he only saw a few plants;

* C. C. Haworth died on 2 December 1989; see Obituaries.

sometimes single specimens. There is no doubt that Dahlstedt was over-liberal in creating names. He should certainly have been more circumspect in naming some of the material, which is clearly unsatisfactory for one reason or another, for example the summer and long-grass forms submitted. In addition, Dahlstedt was an old man and seemingly well past his formidable best. Many sheets with the same name are clearly not the same species. Names were also created for specimens we refer to which had already been published, some by Dahlstedt himself. His descriptions do not always correspond with the material and in some cases are contradictory. No holotypes were selected by Dahlstedt and this has added to our problems. In our preparatory work for a new *Taraxacum* Flora, some cursory investigations revealed that no proper and comprehensive published lectotypification had been carried out. Although, as stated, some sheets had been examined, it soon became apparent that there were many type sheets in other institutional herbaria which seem to have been overlooked, chief of these being **E** where large numbers of Johnston-collected sheets have been found, some with Dahlstedt's original manuscript description and notes attached. Other sheets were found in **K** and **ABD** which bore no sign of ever having been looked at by taraxacologists since they had been deposited. Moreover, even where some attempt at lectotypification of the material in other herbaria had occurred, sufficient attention had not always been given to the date of publication, or even whether the material was a valid syntype with respect to the locality and date of collection of the material.

Added to all this is the very significant factor that our current understanding of the British and Irish *Taraxacum* flora is so much clearer than that when Richards produced his original work. It seemed essential then to gather all the sheets of potential type material together to accomplish a thorough revision and valid lectotypification.

In this we have been mindful of the advice given in the *Botanical Code of Nomenclature*. Our basic criterion has been to interpret the material in relation to its type description and collection details. Wherever possible we have chosen lectotypes from the sheets bearing Dahlstedt's manuscripts which are well developed and well preserved, and have endeavoured to retain most lectotypes in either **OXF** or **E** though other criteria have on occasion over-ridden these considerations. We have assumed that Dahlstedt saw all of the syntype material collected. This is certainly true for all Johnston's material, as he frequently tells us so. In many cases syntype duplicates are annotated by Dahlstedt and we have also assumed this to be the case for Druce's material, although this is nowhere stated. We have, unavoidably, had to leave some names as nomina confusa and others as nomina dubia.

What follows is an alphabetical species-by-species account. For convenience, the publications mentioned above are referred to as *Rep.*, *Trans.* and *Addit.* respectively, with the publication details given. Similarly, where the collector of the material was Druce or Johnston, we have abbreviated these to *GCD* and *HHJ* respectively. Under (a) we show the treatment of each name given by Richards in his Flora, ! indicating that he considered the species acceptable. Under (b) we give our present interpretation, ! meaning that we retain the Richards' one. In (c) we give lectotype details, stating the herbarium where the specimen is lodged. In a few cases where thought useful, we given some brief added comment under (d).

All the herbarium sheets we have examined have been annotated as appropriate, but fuller unpublished notes are retained by A. J. Richards and these are available to interested parties.

LECTOTYPIFICATION AND REVISION

T. acidodontum, *Addit.* 11th paper, 13 (1928). (a) *T. laetifrons* Dahlst. (b) *T. naevosiforme* Dahlst. (c) Near Burnside, Stromness, Mainland, Orkney, 19 May 1927, *HHJ 3553* (**E**).

T. acrifolium, *Trans.* **8**: 621 (1929). (a) ! (b) Nomen dubium. (c) Brough Lodge, Fetlar, Shetland, 30 June 1927, *HHJ 116* (**E**). (d) This appears to be a long-grass form collected rather late in the season and we are wary of its phenotype which we cannot readily equate with any known species. In the circumstances we prefer a cautious interpretation. Re-collection at the type locality is desirable.

T. adsimile, *Rep.* **8**: 622 (1929). (a) ! (b) *T. longisquameum* H. Lindb. fil. (c) Didcot, Berks, May 1928, *GCD* (**OXF**).

T. aequatum, *Rep.* **8**: 622 (1929). (a) *T. lingulatum* Marklund. (b) ! (c) Harwell, Berks., May 1928, *GCD* (**OXF**).

T. alienum, *Rep.* **8**: 30 (1927). (a) *T. cyanolepis* Dahlst. (b) Nomen confusum. (c) Lectotypification impossible. (d) The syntypes are very heterogeneous. The material in **OXF** bearing Dahlstedt's manuscript is scant and there is very little chance of finding the type locality. As the plant may belong to *Taraxacum* section *Hamata* there is all the greater reason for disregarding this name. In his paper describing this section Oellgaard (1983) had grave reservations concerning this taxon and now agrees with our treatment here.

T. anglicum, *Rep.* **5**: 567 (1920). (a) ! (b) ! (c) Oxford, 1919, *GCD* (**OXF**).

T. ardisodon, *Rep.* **8**: 623 (1929). (a) *T. polyodon* Dahlst. (b) ! (c) Druce's Garden in Oxford, May 1928, *GCD* (**OXF**).

T. argutum, *Rep.* **8**: 619 (1929). (a) ! (b) ! (c) Heath, Beds., May 1928, *GCD* (**OXF**).

T. bipinnatifidum, *Trans.* **29**: 416 (1927). (a) Not considered in the Flora. (b) Nomen dubium. (c) Loch of Saint Treadwall, Papa Westray, Orkney, 18 June 1926, *HHJ 3319* (**E**).

T. britannicum, *Rep.* **8**: 30 (1927). (a) *T. adamii* auct. Angl. non Claire (= *T. gelertii* Raunk.). (b) Now accepted as a good species. (c) Oxford, April 1928, *GCD* (**OXF**).

T. calophyllum, *Addit.* 13th paper, 7 (1929). (a) ! (b) *T. stictophyllum* Dahlst. (c) Bu, Bay of Creekland, Hoy, Orkney, 13 May 1929, *HHJ 4211* (**E**).

T. chloroleucophyllum, *Trans.* **29**: 417 (1927). (a) Not considered in the Flora. (b) *T. unguilobum* Dahlst. (c) How, Backaskail Bay, Cross, Sanday, Orkney, 14 June 1926, *HHJ 3298* (**E**).

T. connexum, *Rep.* **9**: 26 (1930). (a) *T. adsimile* Dahlst. (b) *T. ekmani* Dahlst. (c) Banbury Road, Steeple Aston, Oxon., June 1929, *GCD* (**OXF**).

T. cophocentrum, *Rep.* **8**: 624 (1929). (a) ! (b) ! (c) Cothill, Berks., May, 1928, *GCD* (**E**).

T. drucei, *Rep.* **6**: 773 (1923). (a) ! (b) ! (c) Fassaroe, Bray, County Wicklow, Ireland, April 1914, *GCD* (**S**).

T. duplidentifrons, *Addit.* 11th paper, 16 (1928). (a) ! (b) ! (c) Bridge across the Oyce, Finstown-Rendall public road, Firth, Mainland, Orkney, 3 November 1927, *HHJ 3745* (**E**). (d) In recent years this had been considered as a nomen dubium or confusum by some Continental workers and the later name *T. raunkiaerii* Wiinst. was applied to material thought most likely to be this taxon. Despite the late collection, the material newly seen, especially the lectotype, leaves us in no doubt that this name is acceptable for one of the best-understood and most abundant and widespread of our species and we therefore restore this name.

T. fulvicarpum, *Trans.* **29**: 420 (1927). (a) ! (b) ! (c) Holland House, Papa Westray, Orkney, 24 June 1926, *HHJ 3344* (**E**).

T. fulviforme, *Rep.* **6**: 775 (1923). (a) ! (b) ! (c) Gravel path, Oxford, (no date given but *GCD Y99* mentioned in the protologue), *GCD Y99* (**OXF**).

T. glauciniforme, *Rep.* **8**: 620 (1929). (a) ! (b) ! (c) Heath, Beds., May 1928, *GCD* (**OXF**).

T. hamatifrons, *Trans.* **29**: 302 (1926). (a) *T. hamatiforme* Dahlst. (b) *T. naevosiforme* Dahlst. (c) Roadside, Clouster Brae, Stromness, Mainland, Orkney, 1 May 1925, *HHJ 2902* (**E**).

T. hamiferum, *Rep.* **8**: 625 (1929). (a) Pro parte *T. marklundii* Palmgren and pro parte *T. oblongatum* Dahlst. (b) In line with Oellgaard (1983) we now accept this species. (c) Didcot railway station, Berks., May 1928, *GCD* (**OXF**).

T. helvicarpum, *Rep.* **8**: 619 (1929). (a) *T. oxoniense* Dahlst. (b) ! (c) Marlborough, Wilts., April 1928, *Mrs. Wedgewood* (**OXF**).

T. hemipolyodon, *Rep.* **8**: 625 (1929). (a) ! (b) *T. subundulatum* Dahlst. (c) The Parks, Oxford, May 1928, *GCD* (**S**).

T. johnstonii, *Rep.* **6**: 774 (1923). (a) *T. naevosiforme* Dahlst. (b) *T. unguilobum* Dahlst. (c) Links of Mirkady, Durness, Mainland, Orkney, 21 April 1922, *HHJ 1549* (**E**).

T. laetifrons, *Trans.* **29**: 88 (1924). (a) ! (b) *T. stictophyllum* Dahlst. (c) Near Stromness Graveyard, Innertown, Stromness, Mainland, Orkney, 13 June 1923, *HHJ 2265* (**E**).

T. lacerabile, *Rep.* **9**: 27 (1930). (a) ! (b) *T. macrolobum* Dahlst. (c) Wheatley Turn, near Oxford, May 1929, *GCD* (**OXF**).

T. lacerilobum, *Rep.* **9**: 562 (1930). (a) *T. lacerabile* Dahlst. (b) Nomen dubium. (c) Ivinghoe Beacon, Bucks., 14 May 1930, *H. Phillips* (**OXF**). (d) The nature of this material is unclear to us. It may relate to earlier- or later-described species but until study at the type locality is undertaken we must leave this as stated.

T. latispina, *Rep.* **6**: 780 (1923). (a) *T. mucronatum* H. Lindb. fil. (b) *T. longisquameum* H. Lindb. fil. (c) Hailey, Oxford, May 1921, *GCD* (**OXF**).

T. naeviferum, *Rep.* **6**: 778 (1923). (a) *T. laciniosum* Dahlst. (b) *T. polyodon* Dahlst. (c) Wimbledon Park, Surrey, May 1922, *W. A. Todd* (**S**).

T. oblongatum, *Rep.* **9**: 27 (1930). (a) ! (b) ! (c) Marcham, Berks., May 1929, *GCD* (**OXF**).

T. obscuratum, *Rep.* **9**: 27 (1930). (a) ! (b) Nomen dubium. (c) Banbury Rd., Steeple Aston, Oxon., June 1929, *GCD* (**OXF**). (d) This is sparse and late-collected material and although the plant looks of potential interest, we prefer to leave the taxon on one side for the time being.

T. orcadense, *Trans.* **29**: 304 (1926). (a) ! (b) ! (c) Ward Hill, Hoy, Orkney, 12 June 1925, *HHJ 2986* (**E**).

T. oxoniense, *Rep.* **6**: 776 (1923). (a) ! (b) ! (c) Oxford, April 1920, *GCD Z67* (**OXF**).

T. pannulatiforme, *Rep.* **9**: 563 (1932). (a) *?T. linguatum* Dahlst. ex Raunk. (b) Now accepted as a good species. (c) Hitchin, Herts., 1930, *H. Phillips* (**E**).

T. perhamatum, *Rep.* **9**: 28 (1930). (a) *T. oblongatum* Dahlst. (b) ! (c) Elsefield Lane, near Oxford, June 1929, *GCD* (**S**).

T. perlaciniatum, *Trans.* **29**: 421 (1927). (a) *T. orcadense* Dahlst. (b) ! (c) How, Backaskail Bay, Cross, Sanday, Orkney, 14 June 1926, *HHJ 3296* (**E**).

T. platylobum, *Rep.* **10**: 26 (1933).(a) Not considered in the Flora. (b) Nomen dubium. (c) Hitchin, Herts., 7 August 1932, *H. Phillips* (**S**).

T. plicatum, *Addit.* 17th paper, 8 (1934). (a) *T. naevosiforme* Dahlst. (b) ! (c) Holm of Houton, near Orphir, Mainland, Orkney, 5 June 1933, *HHJ 4639* (**E**).

T. porrectidens, *Rep.* **9** (1932). (a) **!** (b) Nomen dubium. (c) Lectotypification impossible. (d) The material was not only collected in late summer it is also clearly heterogeneous and we have no alternative but to leave this name as a nomen dubium.

T. praeradiantifrons, *Rep.* **10**: 27 (1933). (a) Not considered in the Flora. (b) We have yet to locate syntype material of this. In the meantime we must designate it a nomen dubium. (c) Lectotypification impossible.

T. pseudohamatum, *Rep.* **9**: 564 (1932). (a) Pro parte *T. oblongatum* Dahlst. and pro parte *T. hamatum* Raunk. (b) As recognised by Oellgaard (1983) this is an acceptable species. (c) Hitchin, Herts., 1931, *H. Phillips* (**OXF**).

T. recurvilobum, *Rep.* **9**: 564 (1932). (a) *T. porrectidens* Dahlst. (b) Nomen confusum. (c) Lectotypification impossible. (d) The syntypes are either summer forms of different species or are weakened as concepts by Dahlstedt's hand as "allied forms". In the circumstances we must disregard this taxon as referring to anything meaningful.

T. semiprivum, *Rep.* **8**: 626 (1929). (a) *T. alatum* H. Lindb. fil. (b) **!** (c) Harwell, Berks., May 1928, *GCD* (**OXF**).

T. serratilobum, *Trans.* **29**: 418 (1927). (a) *T. laetifrons* Dahlst. (b) *T. unguilobum* Dahlst. (c) Churchyard, Holm, Mainland, Orkney, 3 May 1926, *HHJ 3241* (**E**).

T. shetlandicum, *Trans.* **29**: 429 (1927). (a) *T. laetifrons* Dahlst. (b) Nomen dubium. (c) Leagarth House, Houbie, Fetlar, Shetland, 21 May 1926, *HHJ 20* (**E**). (d) The herbarium material is obscure and seems not to equate very clearly to the type description. It is possible that a good taxon exists but failing further evidence, we must leave this as a nomen dubium.

T. similatum, *Rep.* **8**: 626 (1929). (a) *T. obliquilobum* Dahlst. (b) *T. subundulatum* Dahlst. (c) Abingdon, Berks., May 1928, *GCD* (**OXF**).

T. stenacrum, *Rep.* **8**: 627 (1929). (a) **!** (b) **!** (c) The Parks, Oxford, May 1928, *GCD* (**OXF**).

T. stenoglossum non Brenner, *Rep.* **8**: 627 (1929). (a) *T. cherwellense* A. J. Richards, nom. nov. (b) **!** (c) Shipton, Oxfordshire, May 1927, *GCD* (**OXF**).

T. subexpallidum, *Rep.* **8**: 628 (1929). (a) *T. sublaciniosum* Dahlst. (b) Now accepted as a good species. (c) ex Hort. Druce, Oxford, 5 May 1928, *GCD* (**OXF**).

T. sublatissimum, *Rep.* **9**: 28 (1930). (a) *T. fasciatum* Dahlst. (b) **!** (c) Ham, North Hants., June 1929, *GCD* (**OXF**).

T. sublucescens, *Rep.* **8**: 32 (1927). (a) *T. sublaciniosum* Dahlst. (b) Nomen dubium. (c) Gairloch, West Ross, July 1926, *GCD* (**OXF**). (d) The material is a summer gathering and we cannot treat the scant material as other than as a nomen dubium.

T. submucronatum, *Rep.* **9**: 565 (1932).(a) *T. porrectidens* Dahlst. (b) Nomen dubium. (c) Hitchin, Herts., 1931, *H. Phillips* (**OXF**). (d) The material is weak and could well relate to other published species but at the moment we cannot be sure and thus prefer to leave the taxon as a nomen dubium.

T. subpallescens, *Rep.* **9**: 29 (1930). (a) *T. lingulatum* Marklund. (b) **!** (c) Upton on Severn, Worcester, May 1929, *GCD* (**OXF**).

T. subsagittipotens, *Rep.* **9**: 29 (1930). (a) *T. adsimile* Dahlst. (b) Nomen dubium. (c) Wall, Roman Villa, Northleigh, Oxfordshire, June 1929, *GCD* (**OXF**). (d) It is unfortunate that the only syntypes

were collected so late in the season and furthermore from a wall. The syntypes are dubiously homogeneous. Until the type locality is visited, we prefer to leave this taxon on one side.

T. subsimile, *Trans.* **29**: 89 (1924). (a) **!** (b) *T. naevosum* Dahlst. (c) Carrick House, Eday, Orkney, 7 July 1923, *HHJ 2412* (**E**).

T. subundulatum, *Rep.* **6**: 779 (1923). (a) **!** (b) **!** (c) Hailey, Oxfordshire, 1922, *GCD* (**BM**).

T. tanylepioides, *Trans.* **29**: 303 (1926). (a) *T. orcadense* Dahlst. (b) **!** (c) Links of Boardhouse, Birsay, Mainland, Orkney, 8 June 1925, *HHJ 2959* (**E**).

T. tanylepis, *Rep.* **6**: 776 (1923). (a) **!** (b) **!** (c) Sweyn Holm, Orkney, 29 May 1922, *HHJ 1640* (**E**).

T. tanyphyllum, *Rep.* **9**: 565 (1932). (a) *T. laciniosum* Dahlst. (b) Now accepted as a good species. (c) Ivinghoe, Bucks., 1930, *H. Phillips* (**E**).

T. unguilobiforme, *Addit.* 17th paper, 7 (1934). (a) *T. fulvicarpum* Dahlst. (b) *T. unguilobum* Dahlst. (c) Holm of Houton, near Orphir, Mainland, Orkney, 5 June 1933, *HHJ 4638* (**E**).

T. vachellii, *Rep.* **10**: 26 (1933). (a) *T. hispanicum* H. Lindb. fil. (b) *T. brachyglossum* (Dahlst.) Raunk. (c) Banks of River Wye, *Miss E. Vachell* (**NMW**).

T. valdedentatum, *Rep.* **6**: 777 (1923). (a) **!** (b) Nomen dubium. (c) Wimbledon Common, 20 June 1922, *W. A. Todd* (**S**). (d) All the material being in status aestivalis necessitates us designating this as a nomen dubium. The lectotype is a member of *Taraxacum* section *Hamata* but we cannot assign it to a known species.

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REFERENCES

Oellgaard, H. (1983). *Hamata*, a new section of *Taraxacum* (Asteraceae). *Pl. Syst. Evol.* **141**: 199–217.
Richards, A. J. (1972). *Taraxacum* Flora of the British Isles. *Watsonia* **9**: (supplement).

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Six native species of *Taraxacum* new to the British Isles

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ABSTRACT

Six new species of *Taraxacum* (Compositae) are described from the British Isles. **T. inopinatum** C. C.Haworth, **sp. nov.**, is placed in section *Erythrosperma*; **T. richardsianum** C. C. Haworth, **sp. nov.**, is placed in section *Naevosa*; **T. hesperium** C. C. Haworth, **sp. nov.**, **T. oellgaardii** C. C. Haworth, **sp. nov.** and **T. porteri** C. C.Haworth, **sp. nov.**, are placed in section *Celtica*; and **T. margettsii** C. C. Haworth, **sp. nov.** is placed in section *Ruderalia*.

INTRODUCTION

This is the third paper to publish new species of dandelions from our islands since *The* Taraxacum *flora of the British Isles* (Richards 1972). Richards (1981) and Richards & Haworth (1984) described eleven and nine species respectively, although two of them have subsequently proved to be synonyms (*T. edmondsonii* A. J. Richards is conspecific with *T. pseudolarssonii* A. J. Richards, and *T. ardlense* A. J. Richards is identical to *T. inane* A. J. Richards).

Since these papers were published, intensive study of the genus has continued, and the time seems ripe to describe six further species, all of which are judged to be important endemic members of our native flora. All these species have been cultivated under constant conditions by the author so as to ascertain their distinction from related species.

After ten years' work the author feels that, apart from some species in section *Ruderalia* which may be published before long, we are likely to elucidate rather few further important new species of *Taraxacum* in these islands. There are, in addition, a number of what appear to be very local endemics. At the moment, it is thought unwise to add unduly to the already long list of published species and we intend to retain these and some other unclear variants as informal 'worknames'. Our understanding of the *Taraxacum* flora remains somewhat fluid, and casual introduction of non-native species will doubtless continue to swell the number of species in the British and Irish lists.

For those desiring an up-to-date outline of the genus in Britain and Ireland, the author kept a computer-based annotated list of species and this can be obtained on application to A. J. Richards. The species described here are allocated to sections according to a recent taxonomic revision (Richards 1985). Those wishing to have a useful summary of and key to the sections present in the British Isles are referred to the *Plant crib* (Rich & Rich 1988).

DESCRIPTIONS

1. **Taraxacum inopinatum** C. C. Haworth, **sp. nov.**

HOLOTYPUS: Dean, near Workington, Cumberland, v.c. 70, GR 35/076.248, face of a disused limestone quarry, May 1985, *C. C. Haworth* (**OXF**). Isotypus **herb. C.C.H.** (Fig. 1a).

Planta parva vel mediocris, gracilis. Folia prostrata vel erecta, viridia vel obscure olivaceo-viridia, supra plerumque dispersa inconspicua purpureo-maculata, lanceolata, ad 200 mm longa; lobi laterales 4–6, triangulares vel deltoidei, interdum ad apicem subabrupte contracti, apicibus vagis, plerumque diverse dentati, interdum lobi superiori singulari longo dente subdivisi; lobus terminalis

* C. C. Haworth died on 2 December 1989; see Obituaries. Reprint requests should be sent to Dr A. J. Richards, Biology Dept., The University, Newcastle, NE1 7RU.

FIGURE 1. Holotype specimens of a) *Taraxacum inopinatum*; b) *T. richardsianum*; c) *T. hesperium*.

mediocris, plus minusve acutatus trilobatus, in apicem longum acutum vel subacutum; interlobia sat angusta, vulgo valde diverse angustis dentibus instructa; petiolus ad quartam partem folii longus, gracilis, exalatus, vulgo viridis sed interdum leviter obscure purpureus. Scapi sub anthesi folia aequantes, virides, leviter pilosi. Involucri squamae exteriores erectae vel suberectae, 7–8 × 2–3 mm, supra pallide glaucae et pruinosae, subtus atrovenetae et pruinosissimae, plerumque angustae albo-marginatae; vix corniculatae. Calathium 25–35 mm diametro; ligulis stria purpurea subtus notatis; stylus et stigmata griseo-lutei, epolliniferi. Achenium profundo aurantiaco-brunneum vel rubrum, 3·2–3·4 mm longum (pyramide exclusa), superne subtiliter et acute spinulosum, in pyramidem cylindricam (0·6–0·9 mm longam) abrupte abiens; rostrum 7–8 mm longum; pappus albus.

Plant small to medium-sized, slender. Leaves prostrate to erect, mid to dark olive-green, usually with a scattering of faint purple spots on the adaxial surface, lanceolate, up to 200 mm long; lateral leaf-lobes 4–6, triangular or deltoid, sometimes narrowing rather abruptly to the apex which can be variously directed, usually with some different-sized teeth, sometimes the upper lobes subdivided by a single long tooth; terminal lobe medium-sized, more or less acutely trilobate, with an extenuate acute or sub-acute apex; interlobes rather narrow and usually strongly and variously-lengthened narrow-toothed; petiole to 1/4 of leaf length, slender, unwinged, usually green but occasionally slightly dull purple. Scapes equalling the leaf-length at flowering, green or purple, slightly pilose. Exterior bracts erect or sub-erect, 7–8 × 2–3 mm, pale glaucous and pruinose on the upper surface, very dark glaucous and very pruinose on the lower surface, usually with a narrow white border; scarcely corniculate. Capitulum 25–35 mm in diameter; ligules striped purple below; style and stigmas grey-yellow; pollen absent. Achene dark orange-brown or red, 3·2–3·4 mm long (not including cone), finely and sharply spinulose in the upper part, with a clearly demarcated cylindrical cone 0·6–0·9 mm long; rostrum 7–8 mm; pappus white.

The species is mainly western and grows especially on bare limestone or sand. It occurs in vice-counties 1, 25, 40, 42, 50, 51, 69 and 70.

T. inopinatum appears to be unique amongst British members of section *Erythrosperma* in having spotted foliage and is thus readily identified. The spots are, however, usually faint and well-scattered, and leaves and whole plants occasionally occur without these markings. This species is related to the other common red-fruited species *T. brachyglossum* (Dahlst.) Raunk., *T. lacistophyllum* (Dahlst.) Raunk. and *T. argutum* Dahlst. As well as having a different leaf-shape the first two have pollen, and though *T. argutum* Dahlst. is apolline, the closed capitula readily distinguish that species. Another diagnostic feature of *T. inopinatum* is the involucre, where the outer bracts are erect, very dark glaucous green on the outside, and bear a heavy pruinosity.

2. **Taraxacum richardsianum** C. C. Haworth, **sp. nov.**
HOLOTYPUS: Haile, near Egremont, Cumberland, v.c. 70, GR 35/031.097, grassy banks at woodland edge, *C. C. Haworth* (**OXF**). Isotypus **herb. C.C.H.** (Fig. 1b).

Planta mediocris, subrobusta. Folia patentia vel suberecta, sat hirsuta, atrovirentia, supra multo sat parvo disperso purpureo-maculata, 150–200 mm longa; lobi laterales 6–8, aggregati, recurvati acuti, triangulares, margine distali recto vel leviter sigmoideo et pauce denticulato; lobus terminalis amplus, subacutus, saepe subdivisus magnis dentibus instructus; interlobia indistincta, leviter filiforme-dentata; petiolus exalatus vel subalatus, ad quintam partem folii longus, cum nervo mediano purpureus. Scapi sub anthesi folia aequantes, purpurei, pilosi. Involucri squamae exteriores 10–12 × 2–3 mm, suberecta vel patentes, aliquantum arcuatae, lanceolatae, supra pallide virides, subtus virides, margine albo clare discriminatae. Calathium 35–40 mm diametro; ligulis stria pupurea subtus notatis; stylus et stigmata sordide lutei; epolliniferi (raro in flosculi margines paucis graniis instructi). Achenium stramineo-brunneum, 3·2–3·7 mm longum (pyramide exclusa), superne lato spinulosum, pyramide conica 0·8 mm longa; rostrum 7 mm; pappus albus.

Plant medium-sized, fairly robust. Leaves spreading to sub-erect, rather hairy, dark green, with many scattered rather small purple-black spots on the adaxial surface, 150–200 mm long; lateral leaf

lobes 6–8, crowded, regular, triangular with acute backward-pointing apices, distal margin more or less straight but sometimes slightly sinuose and bearing a few subulate teeth; terminal lobe large, sub-acute, often subdivided with large teeth, apex sub-acute; interlobes broad, slightly filiform-dentate; petiole unwinged or scarcely winged, 1/5 length of leaf; petiole and midrib purple. Scape equal to the length of the leaves at flowering, purple, pilose. Exterior bracts 10–12 × 2–3 mm, sub-erect to patent, somewhat arcuate, lanceolate, pale green on the upper surface, mid green below, with a distinct white border. Capitulum 35–40 mm in diameter; ligules with a purple stripe; style and stigmas discoloured; pollen absent (rarely with a few grains in the outer florets). Achene straw-brown, 3·2–3·7 mm long (not including cone), with broad-based spinules above, cone conical, 0·8 mm long; rostrum 7 mm; pappus white.

This species is a significant member of our dandelion flora. It is often common in moist grasslands in the west and north. In southern England it is confined to herb-rich meadows. It occurs in vice-counties 4, 12, 19, 20, 22, 30, 31, 34, 35, 42, 43, 51, 60, 61, 69, 70, 72, 73 and 103.

Being apolline, *T. richardsianum* resembles the two other common dandelions of a similar colour and size, *T. maculosum* A. J. Richards and *T. euryphyllum* (Dahlst.) M. P. Christiansen. Besides having a quite different involucre, *T. maculosum* has long, narrow leaves with fewer lobes which are very sinuose on the distal margin. In *T. euryphyllum*, the lobes are much more patent and less acute and the petiole is more broadly winged.

Some sheets of this species may still bear the early workname '*T. spilophyllopsis*'. In naming this important species, I am glad to have the opportunity to recognise John Richards' major contribution to British taraxacology.

3. **Taraxacum hesperium** C. C. Haworth, **sp. nov.**
Holotypus: Trackside leading to Loch at Lochmaben, Dumfries, v.c. 72, GR 35/1.8, May 1987, *C. C. Haworth* (**OXF**). Isotypus **herb. C.C.H.** (Fig. 1c).

Planta robusta. Folia erecta, viridia, supra et subtus interlobiis valde piceatis, oblonga, ad 300 mm longa; lobi laterales 5–6, in axem folii saepe asymmetrice dispositi, plus minusve patentes, saepe magnis subobtusis dentibus subdivisi, interdum in apicem sat obtusis linearibus processibus instructum; interlobia angusta et longa, vulgo diverse dentata; lobus terminalis mediocris, obtusus vel subobtusus, irregulariter dentatus; petiolus exalatus vel vix alatus ad quartam partem folii longus, clare purpureus; nervus medianus purpureus intertextus viride rubroque. Scapi sub anthesi folia subaequantes, glabrati, purpurei. Involucri squamae exteriores 10–12 × 2–3 mm, lanceolatae, patentes, arcuatae, supra pallide virides, subtus virides et saepe purpureo-suffusae, pruinosae, emarginatae vel vix marginatae. Calathium 35–45 mm diametro; ligulis stria purpurea subtus notatis; stylus et stigmata sordidi; polliniferi (sed interdum sparse polliniferi). Achenium olivaceo-brunneum, 2·8–3·0 mm longum (pyramide exclusa), superne spinulosum, in pyramidem conicam (0·3–0·4 mm longam) non abrupte abiens; rostrum 5·5–6·5 mm; pappus albus.

Plant robust. Leaves erect, mid green, conspicuously blotched on the interlobes both above and beneath, oblong, to 300 mm long; leaf lobes 5–6, often irregularly arranged along the leaf axis, more or less patent, with large sub-obtuse teeth which often subdivide the lobe, sometimes with rather obtuse linear processes at the apex; interlobes narrow and long, usually toothed; terminal lobe medium-sized, obtuse or sub-obtuse, irregularly dentate; petiole unwinged or scarcely so, to 1/4 length of leaf, bright purple; midrib purple, with interwoven green strands. Scapes more or less equal to the leaves at flowering time, glabrescent, purple. Exterior bracts 10–12 × 2–3 mm, lanceolate, spreading, arcuate, pale green above, darker green below often with some purple colouration, pruinose, unbordered or hardly bordered. Capitulum 35–45 mm in diameter; ligules striped purple below; style and stigmas discoloured; pollen present but sometimes rather sparse. Achene 2·8–3·0 mm long (not including cone), olive-brown, spinulose above, with a conical cone 0·3–0·4 mm long which is not clearly demarcated, 0·3–0·4 mm long; rostrum 5·5–6·5 mm; pappus white.

T. hesperium occurs in vice-counties 6, 19, 23, 30, 36, 42 and 72.

This species is on the morphological interface between sections *Celtica* and *Hamata* and is only placed in the former section on grounds of distribution; the species, as the name suggests, being predominantly western. It is however also known in some eastern counties, although from 'good' habitats. It bears a considerable resemblance to *T. lamprophyllum* M. P. Christiansen which is placed in section *Hamata*. In *T. hesperium* the leaf lobation is more irregular (the lateral leaf lobes often alternating along the axis), the dentation is less uniform, the teeth being fewer and much larger. The exterior bracts are larger and more ovate in *T. lamprophyllum*.

An early workname for this species was '*T. pseudolamprophyllum*'.

4. **Taraxacum oellgaardii** C. C. Haworth, **sp. nov.**

HOLOTYPUS: Upper Warren Avenue, Caversham, Oxford, v.c. 23, GR 41/68.74, meadow at the base of chalk at the west end of tarmac road, 22 April 1984, *H. Øllgaard et al.* (**OXF**). Isotypus **herb. C.C.H.** (Fig. 2a).

Planta mediocris. Folia suberecta, viridia vel lutescenti-viridia, emaculata, oblongata vel lanceolata, ad 200 mm longa; lobi laterales 4–6, plus minusve patentes, triangulares, saepe marginibus distalis sat sigmoideis, acuti, inferiori ad margines distales multis filiforme-dentibus instructos; interlobia plus minusve integra; lobus terminalis mediocris, subacutus, deltoideus, in apicem interdum leviter apiculatum; petiolus ad tertiam partem folii longus, plerumque angusto alatus, lamina petioli viridis ad nervum clarum rubrum abrupte distincta; nervus medianus obscure roseo-purpureus, intertextus viride rubroque. Scapus sub anthesi folia subaequantes, pilosus, deinde glabrescens. Involucri squamae exteriores 8–10 × 2–4 mm, erectae vel suberectae, ovato-lanceolatae, superne pallide virides, subtus viridia saepe purpurea-suffusea, manifeste vel vix marginatae. Calathium 30–40 mm diametro; ligulis stria purpurea subtus notatis; stylus et stigmata sordidi; polliniferi. Achenium 2·6–3·0 mm longum (pyramide exclusa), stramineo-brunneum, superne subtiliter spinulosum, alibi laeve, pyramide conica, 0·5–0·7 mm longa; rostrum 6–8 mm; pappus albus.

Plant medium-sized. Leaves ascending, green or yellow-green, unmarked, oblong to lanceolate, to 200 mm long; lateral lobes 4–6, more or less patent, triangular, frequently rather sigmoid on the distal margin, acute, the lower lobes with many filiform teeth on the distal margin; interlobes more or less entire; terminal lobe medium-sized, deltoid, sometimes slightly apiculate, sub-acute; petiole to 1/3 of leaf length, usually narrowly winged with a sharp contrast between the green lamina and middle bright red portion; midrib dull pink-purple with interwoven red and green strands. Scape about equalling the leaf length, pilose to glabrescent. Exterior bracts 8–10 × 2–4 mm, erect or suberect, ovate-lanceolate, upper surface pale green, lower surface darker green suffused purple, scarcely to conspicuously bordered. Capitulum yellow, 30–40 mm in diameter; ligule stripe purple; style and stigmas discoloured; pollen present. Achene 2·6–3·0 mm long (not including cone), straw brown, with rather fine spinules above and the rest smooth, cone conical, 0·5–0·7 mm long; rostrum 6–8 mm; pappus white.

The species appears to be one of rich meadow habitats and is probably more common than the known distribution suggests. It occurs in vice-counties 23, 26, 34 and 86.

T. oellgaardii is a typical member of section *Celtica* in ecology and morphology. This elegant species most resembles *T. bracteatum* Dahlst., but the foliage here is lighter green and less coriaceous, and the lateral leaf lobes more patent. Nor does it exhibit the typical heterophylly of late-season plants of *T. bracteatum*. The many filiform teeth on the distal margin of the lateral leaf lobes and the relatively small capitulae are useful characters in identification.

This species was first noted by the eminent Danish taraxacologist H. Øllgaard during a field outing of the International Workshop held at Reading in 1984. It is therefore apt as well as pleasurable to be able, with his permission, to dedicate the species to our foremost living taraxacologist. The species has previously been known by the workname of '*T. bracteatiforme*'.

FIGURE 2. Holotype specimens of a) *Taraxacum oellgaardii*; b) *T. porteri*; c) *T. margettsii*.

5. **Taraxacum porteri** C. C. Haworth, **sp. nov.**
HOLOTYPUS: Grassy area in car-park of public house, Deffenyogg, Breconshire, v.c. 42, GR 22/92.27, April 1984, *C. C. Haworth, R. J. Pankhurst & M. Porter* (**OXF**). (Fig. 2b).

Planta mediocris vel alta, sat robusta. Folia suberecta vel erecta, obscure atrovirentia, interdum interlobiis leviter piceatis, oblonga vel oblanceolata, ad 300 mm longa; lobi laterales 4–5, triangulares vel deltoidei, patentes, in apicem filiforme-acutum, saepe marginibus distalis dentibus filiformis munitis; lobus terminalis mediocris, acutatus triangularis vel trilobatus, interdum in apicem apiculatum; interlobia integres vel leviter filiformiter dentata; petiolus ad tertiam partem folii longus, petiolus et nervus medianus obscure purpureus intertextus viride rubroque. Scapi sub anthesi foliis aequantes, sat pilosi, obscure virides vel purpurei. Involucri squamae exteriores 8–12 × 2–4 mm, erectae, ovatae vel lanceolatae, supra pallide virides, subtus atrovirentes, in apicem anthocyane suffusum, marginatae, sat pruinosae. Calathium 40–50 mm diametro; ligulis stria purpurea subtus notatis; stylus et stigmata sordidi; polliniferi. Achenium pallide stramineo-brunneum, 3·0–3·2 mm longum (pyramide exclusa), superne lato spinulosum, alibi rugosum, pyramide subcylindrica 0·5–0·6 mm longa; rostrum 9–10 mm; pappus albus.

Plant medium-sized to tall, fairly robust. Leaves ascending to erect, dull dark green, sometimes with a slight dark blotch at the interlobes, oblong to oblanceolate, to 300 mm long; lateral leaf lobes 4–5, triangular or deltoid, patent, with filiform acute apices, often with a few filiform teeth on the distal margin; terminal lobe medium-sized, acutely triangular or trilobate, the apex sometimes apiculate; interlobes entire or lightly filiform dentate; petiole to 1/3 of leaf length, petiole and midrib dull purple with interwoven green and coloured strands. Scape equal to length of leaves at flowering time, moderately pilose, dull green or purple. Exterior bracts 8–12 × 2–4 mm, erect, ovate or lanceolate, upper surface green, lower dark green, suffused with anthocyanin towards the tip, bordered, somewhat pruinose. Capitulum 40–50 mm in diameter, ligules striped purple; style and stigmas discoloured, pollen present. Achene 3·0–3·2 mm long (cone excluded), pale straw-brown, more or less rugose throughout and with broad-based spinules at the apex, cone cylindrical-conical 0·5–0·6 mm long; rostrum 9–10 mm; pappus white.

T. porteri appears to be confined to Wales and some Welsh border counties, where it can be frequent on grassy banks along hedgerows. It occurs in vice-counties 34, 42, 43, 51 and 58.

This is a striking member of section *Celtica*, with its dark green, acute foliage and with very deltoid or triangular leaf-lobation and dark, erect external bracts. It cannot readily be confused with any other British dandelion.

6. **Taraxacum margettsii** C. C. Haworth, **sp. nov.**
HOLOTYPUS: Cliff above Halzephron Cove, Gunwalloe, The Lizard, West Cornwall, v.c. 1, GR 10/655.215, *L. Margetts D 174* (**OXF**). Isotypus **herb C.C.H.** (Fig. 2c).

Planta mediocris sat magna. Folia erecta, viridia, emaculata, nitida, crassiuscula, oblongata vel spathulata, ad 200 mm longa; lobi laterales foliorum exteriorum 3–4, lati, in axem irregulariter dispositi, latis et curtis subobtusis vel obtusis dentibus irregulariter subdivisi; lobi laterales folia interiores 1–3, latissimi; interlobia folia exteriores et interiores lata, plus minusve dentata; lobus terminalis foliorum exteriorum sat magnus, 0–3 numero variabilis obtusis et curtis dentibus instructus, apice rotundato; lobus terminalis foliorum interiorum maximus, apice rotundato; petiolus foliorum exteriorum viridis, ad basim exalatus sed super alatus et in marginem decurrentem lobi infimi transiens; petiolus foliorum interiorum interdum ad basim leviter roseus. Scapi sub anthesi plus minusve folia aequantes, virides vel rosei, glabri. Involucri squamae exteriores 9–11 × 4–5 mm, patentes, supra obscure subvinoso-griseae, pruinosae, subtus subobscure virides, marginatae. Calathium diametro c. 40 mm, obscure luteum, ligulis stria cano-violacea; stylus et stigmata sordidi; polliniferi. Achenium stramineo-brunneum, 3·0–3·5 mm longum (pyramide exclusa), superne breviter spinulosum, alibi laeve, pyramide conica, 0·8–1·0 mm longa; rostrum 10–11 mm; pappus albus.

Plant medium-sized to large. Leaves erect, mid green, unmarked, shiny, rather thick, oblong or spathulate, to 200 mm long; lateral lobes of outer leaves 3–4, wide, irregularly arranged, irregularly subdivided with broad-based obtuse to sub-acute teeth; lateral lobes of inner leaves 1–3, very broad; interlobes of outer and inner leaves broad with several medium-sized teeth; terminal lobe of outer leaves rather large, with up to three blunt short teeth, rounded at the apex; terminal lobe of inner leaves very large, rounded at the apex; petiole of outer leaves green at the base, unwinged but becomes winged above the merging into the decurrent margin of the lowest lobe; petiole of inner leaves sometimes faintly pink. Scapes green or pink, glabrous. Exterior bracts 9–11 × 4–5 mm, patent, the upper surface full grey-pink, pruinose, lower surface dull green, bordered. Capitula deep yellow, about 40 mm across; ligule striped grey-violet; style and stigmas discoloured; pollen present. Achene 3·0–3·5 mm, straw-brown, broad, shortly spinulose above but the rest smooth, cone conical, 0·8–1·0 mm; rostrum 10–11 mm; pappus white.

The species is only known from the Lizard peninsula, where it appears to be a prominent member of that area's distinguished flora. The shiny, thick foliage, somewhat spathulate leaf-shaped and bordered, spreading bracts all suggest that *T. margettsii* belongs to the group of *Ruderalia* species centred on *T. lucidum* Dahlst. The outer leaves are of an intricate and unusual shape and render the plant most distinctive.

I am most grateful to Mr. L. J. Margetts for his energies in collecting and plotting the distribution of this interesting species which is referred to as "*Taraxacum* sp." in his account of critical plants of the Lizard district of Cornwall (Margetts 1988).

ACKNOWLEDGMENTS

I am indebted to a large number of collectors over the years who have helped me elucidate these species and understand their distribution. In particular I would like to mention L. J. Margetts, M. Marsden and M. Porter. T. Edmondson has also given me constant critical support. Above all I would like to express my gratitude to A. J. Richards for his general guidance over many years, without which this paper would not have been possible.

REFERENCES

Margetts, L. J. (1988). *The difficult and critical plants of the Lizard district of Cornwall*. Bristol.
Rich, T. C. G. & Rich, M. D. B. (1988). *Plant crib*. London.
Richards, A. J. (1972). *Taraxacum* Flora of the British Isles. *Watsonia* **9** (Supplement).
Richards, A. J. (1981). New species of *Taraxacum* from the British Isles. *Watsonia* **13**: 185–193.
Richards, A. J. & Haworth, C. C. (1984). Further new species of *Taraxacum* from the British Isles. *Watsonia* **15**: 85–94.
Richards, A. J. (1985). Sectional nomenclature in *Taraxacum* (Asteraceae). *Taxon* **34**: 633–644.

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Three natural hybrids in *Ranunculus* L. subgenus *Batrachium* (DC.) A. Gray

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ABSTRACT

Accounts are given of three naturally occurring hybrids in *Ranunculus* subgenus *Batrachium* which are relatively widespread and frequently recorded independently of their parent species. Binomials are supplied for two of the hybrids, **R.** × **novae-forestae** S. Webster, **hybr. nov.** (*R. omiophyllus* Ten. × *tripartitus* DC.) and **R.** × **kelchoensis** S. Webster, **hybr. nov.** (*R. fluitans* Lam. × *peltatus* Schrank) and the typification of the third, *R.* × *bachii* Wirtgen (*R. fluitans* × *trichophyllus* Chaix & *R. fluitans* × *aquatilis* L.), is discussed. Descriptions are given and specimens are cited.

INTRODUCTION

A large number of naturally occurring hybrids have been reported in *Ranunculus* subgenus *Batrachium* (Cook 1966, 1970, 1975). Of these, some, such as *R. omiophyllus* × *peltatus* (Williams 1926; Webster 1986) and *R. aquatilis* × *trichophyllus* (Cook 1966) are sporadic and local, and generally occur only where both parents are found growing together. Others are more widespread and are frequently recorded independently of the parent species, which they sometimes replace in a habitat. This distinction is not clear-cut, and information concerning the distribution and 'independence' of many hybrids in the group is incomplete, but for the moment there are three hybrids which clearly fall into the latter group, and merit binomials. One of these, *R.* × *bachii* (*R. fluitans* × *trichophyllus* and *R. fluitans* × *aquatilis*) has previously been described, and the typification of this plant is discussed. The other two, *R. omiophyllus* × *tripartitus* and *R. fluitans* × *peltatus*, are given binomials and descriptions below.

R. OMIOPHYLLUS TEN. × *TRIPARTITUS* DC.

This hybrid grows independently of its parents at a number of localities in the New Forest. Early collections were usually called *R. lutarius* by British botanists and a full description of the plants is given under this name by Clapham (1952). *R. lutarius* (Revel) Bouvet is, however, merely a synonym of *R. tripartitus* based on a terrestrial plant lacking capillary leaves (Cook 1966), while Clapham's (1952) concept of *R. lutarius* appears to have extended to both the hybrid and certain forms of *R. tripartitus* (cf. Clapham 1962). No name is available for the New Forest plant, and a binomial and description are therefore given below.

R. × **novae-forestae** S. Webster, **hybr. nov.** (*R. omiophyllus* Ten. × *tripartitus* DC.)
R. lutarius auct. angl.
HOLOTYPE: Gravel pits, Setley, near Brockenhurst, S. Hants., 2 April 1877, *H. & J. Groves* (as *Ranunculus lutarius* (Bouvet)), ex herb. H. & J. Groves (**BM**). Illustrated in Fig. 1.

Herba annua vel raro perennis. Caules in statu terrestri prostrati vel sub aqua effusi-erecti, ad nodos radicantes. Folia laminaria vel in segmenta capillaria divisa. Folia laminaria alterna; stipulae obovatae vel suborbiculares, apice rotundae; petiolus 15–80 mm longus; lamina usque ad 20 mm longa et 22 mm lata reniformis vel suborbicularis, in 3 lobos lateris rectis, latis sinibus separatos

FIGURE 1. Holotype of *Ranunculus* × *novae-forestae* S. Webster (*R. omiophyllus* Ten. × *tripartitus* DC.), showing laminar, capillary and intermediate leaves and flowering and fruiting heads.

profunde divisa vel in 5 lobos lateris rotundatis sinibus angustis separatos vel imbricatos minus profunde divisa; lobi cuneati, margine crenati vel dentati. Folia capillaria alterna, saepe absentia; petiolus 7–37 mm longus; lamina 20–25 mm longa, globosa vel obconica, segmentis paucis saepe aliquantum applanatis. Folia in forma intermedia inter laminaria et capillaria saepe praesentia. Pedicellus in fructu 8–33 mm longus, petiolo folii laminaris oppositi brevior vel raro ei aequalis, rectus vel curvatus. Sepala 1·5–2·5 mm longa, reflexa, caduca, apice atria. Petala 0–5, 2·5–6 mm longa, quam sepala plus quam duplo longioria, ovata-elliptica vel obovata, non contigua, nectarium lunatum ferentia. Stamina 0–8; carpella (3–)5–18(–30), glabra; stylus lateralis. Saltem aliqui fructus bene formati ex quoque flore crescentes. Receptaculum pubescens.

Annual, or occasionally perennial. Prostrate in terrestrial state or spreading-erect under water, rooting at the nodes. Leaves laminar or divided into capillary segments. Laminar leaves alternate; stipules obovate to suborbicular, the apex rounded; petiole 15–80 mm long; lamina up to 20 mm × 22 mm, reniform to suborbicular, deeply divided into 3 lobes with straight sides separated by wide sinuses or less deeply divided into 5 lobes with rounded sides, separated by narrow sinuses or overlapping; lobes cuneate, margin crenate or dentate. Capillary leaves alternate, frequently absent; petiole 7–37 mm long; lamina 20–25 mm long, globose to obconical; segments few, often somewhat flattened. Leaves intermediate between laminar and capillary frequently present. Pedicels in fruit 8–33 mm, shorter than, or occasionally equal to, the petioles of the opposed laminar leaf, straight or recurved. Sepals 1·5–2·5 mm long, reflexed, caducous, black-tipped. Petals 0–5, 2·5–6 mm long, exceeding twice the length of the sepals, ovate-elliptical to obovate, not contiguous, nectar-pits lunate. Stamens 0–8; carpels (3–)5–18(–30), glabrous; style lateral. At least some well-formed fruits developing from each flower. Receptacle hairy.

The following specimens have been examined, all from S. Hants., v.c. 11: Near Brockenhurst, New Forest, 16 April 1914 and 19 May 1914, *R. S. Standen* (**BM**, **CGE**, **E**), cf. *Rep. Watson bot. Exch. Club* **2**: 480, 1915. Pond, near Brockenhurst, 14 April 1876, *H. & J. Groves* (**E**). Setley, Brockenhurst, April 1877, *H. & J. Groves* (**CGE**). Pond near Holmesley Station, June 1916, *J. Comber* (**CGE**, **RNG**), cf. *Rep. Watson bot. Exch. Club* **3**: 8, 1917. Small pool between Hinton Admiral and Holmesley, 9 May 1934, *J. E. Lousley* (**RNG**). Ditch, Brockenhurst, 12 May 1900, *D. T. Playfair* (**E**). Pools, Setley Gravel Pit Reserve, Setley Plain, Boldre, GR 40/304.996, 27 April 1980, *R. P. Bowman* (**herb. R.P.B.**). Lower Howen Bottom, Fritham, GR 41/231.151, 19 May 1977, *R. P. Bowman* (**herb. R.P.B.**). Pool by footbridge, Fletchers Thorns, Brockenhurst, GR 41/279.042, 23 May 1986, *R. P. Bowman* (**herb. R.P.B.**). Muddy pond W. of and near A337 road, New Park, Brockenhurst, GR 41/301.046, 5 June 1976, *R. P. Bowman* (**herb. R.P.B.**). Small pool by footbridge on heath, Balmer Lawn, Brockenhurst, GR 41/306.035, 14 May 1977, *R. P. Bowman* (**herb. R.P.B.**). Clay flush near Avon Water, Boundway Hill, Sway, GR 40/263.988, 1 May 1977, *R. P. Bowman* (**herb. R.P.B.**).

Accounts of this hybrid are given by Cook (1966, p.187; 1975). The hybrid resembles *R. tripartitus*, except that the petals are larger, up to 6 mm long (the petals are up to 4·5 mm long in *R. tripartitus*) and the laminar leaves are frequently 5-lobed with shallower sinuses and curved lobes. The pedicels often remain erect at maturity. The plants frequently lack capillary leaves and when these are present they consist of somewhat flattened, non-collapsing segments. The hybrid differs from *R. omiophyllus* in its hairy receptacle (glabrous in *R. omiophyllus*), its capacity to form capillary and intermediate leaves, and in its laminar leaves which have deeper sinuses and straighter edges to the lobes. Populations are heterogeneous, containing plants which are variable in both morphology and fertility. They include the products of selfing and back-crossing, some of which are extremely close to *R. tripartitus*. Populations which have been sampled have been shown to be pentaploid (2n = 40). In this and their morphology they resemble synthesized hybrids between *R. omiophyllus* (tetraploid, 2n = 32) and *R. tripartitus* (hexaploid, 2n = 48).

This hybrid has frequently been recorded near Brockenhurst, Holmsley, Setley, Boldre and Sway. It is usually found in or around small pools, but it has occasionally been recorded from larger bodies of water, such as Hatchet Pond (Cook 1966). It also occurs in and beside small streams and drainage channels, flushes, flood hollows and poached mud at cattle crossings; most frequently on clay substrata, including the calcareous Headon Beds in the southern New Forest, apparently in less

acid water generally than *R. omiophyllus*. Both are occasionally found at the same locality (R. P. Bowman, pers. comm.). Recent records indicate that it is still widespread in the area.

Because of the difficulty of separating back-crossed hybrids from *R. tripartitus*, it is hard to be certain whether there is any pure *R. tripartitus* in the New Forest. This is a question of considerable interest, since *R. tripartitus* is a rare plant in the British Isles. There are no certain recent records, but both R. P. Bowman and Alison Bolton have collected plants from the New Forest which are extremely close to *R. tripartitus*. It is highly desirable that the chromosome numbers of these populations should be counted to see whether plants which are morphologically close to *R. tripartitus* have the same chromosome number as this species, that is, 2n = 48, (hexaploid) or whether they have the pentaploid complement 2n = 40 which is the only number to have been recorded so far for known hybrids. Even if the plants are hexaploid, it is still conceivable that they have arisen from (pentaploid) hybrids which have formed triploid gametes. (Since we are talking about backcrosses, it is also possible that aneuploids with chromosome numbers between 2n = 40 and 2n = 48 may be present; Zander & Wiegleb (1987) reported aneuploid variants within populations of *Ranunculus* subgenus *Batrachium* in Lower Saxony. Cook (1966) suggested that some agamospermous process may be taking place.) A better knowledge of the chromosome numbers of particular populations may enable more precise morphological markers to be pinpointed. The other parent, *R. omiophyllus*, is frequent in muddy tracks and stream-sides in the New Forest.

R. FLUITANS LAM. × *PELTATUS* SCHRANK

This hybrid, although sterile, is a robust perennial found in some river systems, where it spreads vegetatively and replaces its parent species. It has been recorded growing independently of its parents at a number of localities in rivers in England, Scotland and Ireland. No name is available for these plants and a binomial and description are therefore given below.

R. × kelchoensis S. Webster, **hybr. nov.** (*R. fluitans* Lam. × *peltatus* Schrank)
HOLOTYPE: Teviot, nr Roxburgh Castle, Roxburgh, 31 July 1878, *A. Brotherston* (as *Ranunculus bachii*), ex herb. J. T. I. Boswell-Syme (**BM**) (Isolectotypes in **E**, **LIV**). Illustrated in Fig. 2.

Herba perennis robusta. Caules sub aqua longi effusi, ad nodos inferiores solum radicantes. Folia laminaria vel in segmenta capillaria divisa. Folia laminaria alterna, aliquando absentia; stipulae oblongae, a petiolo per totem longitudinem adnatae, apice obtusae; petiolus 35–74 mm longus; lamina usque ad 20 mm longa et 35 mm lata, reniformis, basi truncata, in 3–5 lobos rotundatos non profunde divisa. Folia capillaria semper praesentia, alterna; petiolus 5–55 mm longus; lamina 33–85 mm longa, obconica, segmentis paucis (plerumque 7–15) saepe aliquantum applanatis, leviter irregulariterque divergentis, ex aqua non collabentis. Folia in forma inter laminaria et capillaria intermedia saepe praesentia. Pedicellus in fructu 15–90 mm longus, petiolo folii laminaris oppositi brevior vel ei aequalis, rectus vel aliquantum curvatus. Sepala 3–5 mm, viridia patentia persistentia. Petala 5–10, 7–13 mm longa, obovata, nectarium pyriforme ferentia. Stamina numerosa; carpella 50–60, glabra, sterilia; stylus lateralis, elongatus. Receptaculum pubescens.

Robust perennial, with long spreading stems under the water, rooting at lower nodes only. Leaves laminar or divided into capillary segments. Laminar leaves alternate, sometimes absent; stipules oblong, adnate to petiole for their entire length, apex obtuse; petiole 35–74 mm long; lamina up to 20 × 35 mm, reniform, truncate at the base, shallowly divided into 3–5 rounded lobes. Capillary leaves invariably present, alternate; petiole 5–55 mm long; lamina 33–85 mm long, obconical. Segments few (frequently 7–15), often somewhat flattened, slightly untidily divergent, not collapsing together when withdrawn from water. Leaves intermediate between laminar and capillary frequently present. Pedicel in fruit 15–90 mm long, shorter than, or equalling the petiole of the opposed laminar leaf, straight or slightly curved. Sepals 3–5 mm, green, spreading, persistent. Petals 5–10, 7–13 mm, obovate, contiguous during anthesis, nectar-pits pyriform. Stamens numerous. Carpels 50–60, glabrous, sterile. Style lateral, elongated. Receptacle hairy.

FIGURE 2. Holotype of *Ranunculus* × *kelchoensis* S. Webster (*R. fluitans* Lam. × *peltatus* Schrank), showing laminar, capillary and intermediate leaves, flowers and pedicels bearing heads of sterile carpels.

The following specimens have been examined: N. Devon, v.c. 4: R. Taw, just below Wash House Bridge of L. & S. W. Rly, Chawleigh Parish, 4 July 1909, *W. P. Hiern* (**RAMM**); R. Taw, opposite Eggesford railway station, Wembworthy Parish, 13 June 1906, *W. P. Hiern* (**RAMM**). Northants., v.c. 32: Peakirk, 19 June 1959, *C. D. K. Cook* (**CGE**). Derbys., v.c. 57: Brailsford Brook, Derby, 10 September 1888, *W. R. Linton* (**BM**). Westmorland, v.c. 69: Appleby, shallows of R. Eden, 3 July 1961, *P. H. Raven 16230* (**BM**). Roxburghs., v.c. 80: R. Tweed nr Banff Mid Boat, Roxburgh, August 1875, *A. Brotherston* (**CGE**); R. Teviot, nr Roxburgh Castle, Roxburgh, July 1876, *A. Brotherston* ex herb. J. T. I. Boswell-Syme (**BM**); R. Teviot, near Kelso, 4 August 1876, *F. M. Webb* (**E**). Berwicks., v.c. 81: Whitadder, June 1841, *J. T. Syme* (**BM**); Whitadder, Allanton, July 1841, *J. T. Syme* (**E**); ibid, 24 August 1886 (**E**). Antrim, v.c. H39: Six Mile River, Templepatrick, 20 June 1868, *S. A. Stewart* (**BEL**). France: Le Cher, *A. Felix* (**BM**); Boises de l'Ile Chevire près Nantes, 9 July 1876, *A. Felix* (**BM**).

Accounts of this hybrid are given by Cook (1966, pp. 202–3; 1975). It is morphologically intermediate between the parents except that the receptacle is hairy (it is glabrous or sparsely pubescent in *R. fluitans*) and that it develops some leaves that are morphologically intermediate between laminar and capillary. In summer, it develops some laminar leaves that resemble those of *R. peltatus*. (*R. fluitans* does not form laminar leaves.) It is very robust and is sterile.

The hybrid spreads vegetatively and is capable of replacing its parent species. It is pentaploid (2n = 40). The parents, *R. fluitans* and *R. peltatus* both exist at both the diploid (2n = 16) and tetraploid (2n = 32) levels. *R.* × *kelchoensis*, or plants like it, are thought to have given rise to amphidiploids in the *R. penicillatus* (Dumort.) Bab. aggregate (probably subsp. *penicillatus*, i.e. plants with laminar leaves).

Cook (1975) stated that the hybrid was known from between Market Deeping and Crowland in the River Welland and some of its tributaries in Northants., v.c. 32, S. Lincs., v.c. 53 and Leics., v.c. 55. However, Clive Stace and I were unable to find definite material in the River Welland in 1986. Some of the best herbarium specimens come from The Borders region of Scotland, although there are rather few recent records. The epithet *kelchoensis* is derived from "Ordo Kelchoensis" which was recorded in c. 1203 for Kelso (Johnston 1934).

R. FLUITANS LAM. × *TRICHOPHYLLUS* CHAIX AND *R. FLUITANS* LAM. × *AQUATILIS* L.

Like *R.* × *kelchoensis*, these hybrids are sterile, and because they are robust perennials which spread vegetatively, they dominate stretches of several river systems both in Britain and elsewhere in Europe, replacing their parent species. The name *R.* × *bachii* already exists for these hybrids, which are indistinguishable morphologically, and the typification of this name is discussed below, followed by an English description.

R. × **bachii** (Wirtgen) Wirtgen, *Verh. naturh. ver. preuss. Rheinl.*, **3**: 33 (1846).
Batrachium bachii Wirtgen, *Verh. naturh. ver. preuss. Rheinl.*, **3**: 8 (1846).

In June 1844, the Prussian botanist Philipp Wirtgen discovered some unusual stands of batrachian *Ranunculi* in the River Sayn and adjacent mill-races between Sayn and Isenburg, near Koblenz. He provisionally named these plants *R. bachii* (Wirtgen 1845) and subsequently described them as *Batrachium bachii* (Wirtgen 1846a). He referred to it as *Ranunculus bachii* in a subsequent paper, thus providing a combination under this name (Wirtgen 1846b). Unfortunately, Wirtgen's herbarium in **BONN** was destroyed in 1944 and I have been unable to find any specimens collected and named *R. bachii* by him with a date prior to 1846. However, there are number of specimens collected by Wirtgen in **MSTR** and one of these corresponds with the location given by him in 1846. This is labelled, "*Ranunculus fluitans* Lmk β *Bachii* Wtg. In der Sayn bei Isenburg. Lgt & Com. Wirtgen. Herbarium Karlch" without a date. Although it would be premature to typify the name *R.* × *bachii* formally, this material gives a clear indication of what his plant was, since it was collected from the same place, and may even be a suitable type. A similar, undated, specimen exists in **BM** and is labelled, "In der Saynbache b. Isenburg unweit Coblenz. Wirtgen". I am confident that both the **MSTR** and the **BM** specimen are either the hybrid *R. fluitans* × *trichophyllus* or *R. fluitans* × *aquatilis*.

The name *R. cambricus* A. Bennett, which has been applied almost exculsively to plants from Llyn Coron, Anglesey, v.c. 52 (see Bennett 1892), may be synonymous with *R. bachii*. The Anglesey plants resemble *R.* × *bachii* morphologically and in being sterile. However, it is also possible that *R. cambricus* is simply *R. fluitans* growing in an unfavourable habitat: unlike collections of *R.* × *bachii*, *R. cambricus* has almost always been recorded from the lake itself, while *R. fluitans* proper occurs in the Afon Ffraw, the outflow stream (Roberts 1982).

Description: Perennial, with long spreading stems, rooting at the lower nodes or throughout the stem. Capillary leaves invariably present, alternate; stipules triangular to oblong, adnate to the petiole for their entire length; petiole 0–25 mm long; lamina 25–55(–115) mm long. Segments few, frequently only 20–30, semi-rigid, untidily divergent. Pedicel 5–55 mm. Sepals 5, 3–4 mm long, green, or sometimes black-tipped, spreading, persistent. Petals 5, 5–8 mm long, obovate. Nectar-pit lunate or pyriform. Stamens variable in number. Carpels numerous, hairy, sterile. Receptacle hairy.

The following specimens have been examined: S. & W. Lancs., v.cc. 59 & 60: in the River Ribble, near Preston, July 1914, *A. Wilson* (**BM, E, LIV**), cf. *Rep. botl Soc. Exch. Club Br. Isl.* **4**: 113, 1915. W. Lancs., v.c. 60: R. Ribble near Hellifield, 17 July, *A. E. Ratcliffe* (**LIV**). N. E. Yorks., v.c. 62: River Swale, Maidens Bower, Topcliffe, 23 August 1947, *C. M. Rob* (**E**), cf. *Yb. bot. Soc. Br. Isl.* **1949**: 77. Mid-W. Yorks., v.c. 64: River Wharfe, near Ilkley, July 1904, *A. Wilson* (**BM, E, LANC**); In the Wharfe at Woodhall Bridge, near Wetherby, June 1911, *A. E. Bradley* (**BM**); R. Wharfe E. of Pool Bridge, GR 44/244.455, 21 July 1989, *Mrs P. P. Abbott & C. D. Preston 89/235* (**CGE**). Berwicks., v.c. 81: In the Eye Water between East Reston and Aytonlaw, 16 July 1900, *C. Bailey* (**BM, CGE, E, LIV**); In the sluice feeding the paper mill at Ayton, 13 July 1900, *C. Bailey* (**BM**). Germany, Rhineland Palatinate: In der Sayn bei Isenburg, *P. W. Wirtgen* (**MSTR**); In der Saynbache b. Isenburg unweit Coblenz, *P. W. Wirtgen* (**BM**); Dans les eaux rapides près Coblence (Prusse), 15 July 1853, *P. W. Wirtgen* (**BM, CGE**); In der Sayn = Bach im Isenburger Thale, 3 Stunden nördlich von Coblenz, 2 July 1867, *Oskar Schlickum* (**BM**).

Accounts of *R.* × *bachii* are given by Wirtgen (1845, 1846) and Cook (1966, pp. 203–204, 1975). It is not possible to distinguish between *R. fluitans* × *trichophyllus* and *R. fluitans* × *aquatilis* on morphological characters since the hybrids are genotypically and phenotypically very variable. However, the two combinations can be distinguished cytologically since *R. fluitans* × *trichophyllus* is triploid (2n = 24) and *R. fluitans* × *aquatilis* is pentaploid (2n = 40). According to Cook (1975), the name *R.* × *bachii* probably strictly refers to *R. fluitans* × *trichophyllus*. In addition to their sterility, the hybrids differ from the parents as follows: from *R. fluitans* in their shorter, more divergent leaves, shorter pedicel, smaller flowers and hairy receptacle; from *R. trichophyllus* in the perennial habit (although *R. trichophyllus* is capable of persisting as a perennial in permanent water in the absence of more competitive species (cf. Cook 1966, p. 134)), larger flowers (petals up to 8 mm long, cf. up to 5·5 mm in *R. trichophyllus*), and leaves which are more obconical (cf. more globose in *R. trichophyllus*) with segments more subparallel (divergent in *R. trichophyllus*); from *R. aquatilis* in the perennial habit (although with the same reservation as for *R. trichophyllus*), the absence of laminar leaves, and more obconical capillary leaves with segments more subparallel. The hybrids resemble *R. penicillatus* subsp. *pseudofluitans* (Syme) S. Webster except for their generally smaller flowers and less numerous leaf-segments, and their sterility, and *R.* × *bachii* may have given rise to the amphidiploids in this subspecies of *R. penicillatus*. Cook (1975) reports *R.* × *bachii* from Dorset (v.c. 9), W. Gloucs. (v.c. 34), Warks. (v.c. 38), Staffs. (v.c. 39), Denbs. (v.c. 50), Derbys. (v.c. 57), S. Northumb. (v.c. 67) and Midlothian (v.c. 83).

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REFERENCES

BENNETT, A. (1892). Species, varieties, etc., described or observed in Great Britain and Ireland since the publication of Babington's Manual, ed. 8 (1881) and Hooker's Student's Flora, ed. 3 (1884). *Sci. Gossip* **28**: 198–201.

CLAPHAM, A. R. (1952). Ranunculaceae, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*. Cambridge.

CLAPHAM, A. R. (1962). Ranunculaceae, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed. Cambridge.

COOK, C. D. K. (1966). A monographic study of *Ranunculus* subgenus *Batrachium* (DC.) A. Gray. *Mitt. bot. StSamml., Münch.* **6**: 57–237.

COOK, C. D. K. (1970). Hybridization in the evolution of *Batrachium*. *Taxon* **19**: 161–166.

COOK, C. D. K. (1975). *Ranunculus* subgenus *Batrachium*, in STACE, C. A., ed. *Hybridization and the flora of the British Isles*. London.

JOHNSTON, J. B. (1934). *Place-names of Scotland*, 3rd ed. *London*.

ROBERTS, R. H. (1982). *The flowering plants and ferns of Anglesey*. Cardiff.

WEBSTER, S. D. (1986). Two natural hybrids in *Ranunculus* L. subgenus *Batrachium* (DC.) A. Gray. *Watsonia* **16**: 25–30.

WILLIAMS, I. A. (1926). *Ranunculus* × *hiltonii*. *J. Bot., Lond.* **64**: 250.

WIRTGEN, P.[W.] (1845). Zweiter Nachtrag zur Flora der preuss. Rheinlande. *Verh. naturh. Ver. preuss. Rheinl.* **2**: 22–32.

WIRTGEN, P.[W.] (1846a). *Batrachium Bachii* Wirtg.: eine neue Pflanzenspecies. *Verh. naturh. Ver. preuss. Rheinl.* **3**: 8–10.

WIRTGEN, P.[W.] (1846b). Dritter Nachtrag zu dem Prodromus der Flora der preuss. Rheinlande. *Verh. naturh. ver. preuss. Rheinl.* **3**: 33–45.

ZANDER, B. & WIEGLEB, G. (1987). Biosystematische Untersuchungen an Populationen von *Ranunculus* subgen. *Batrachium* in Nordwest-Deutschland. *Bot. Jb.* **109**: 81–130.

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The nomenclature of some hybrids of the *Spiraea salicifolia* group naturalized in Britain

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ABSTRACT

Some hybrids of *S. salicifolia* L. (Rosaceae) naturalized in Britain are discussed. *S. douglasii* Hooker × *S. salicifolia* has hitherto lacked a legitimate binomial and is described as **S. × pseudosalicifolia** Silverside, **hybr. nov.** It is widespread in Britain but has been confused with *S. × billardii* Hérincq (*S. alba* Du Roi × *S. douglasii*). When *S. latifolia* (Aiton) Borkh. is treated as conspecific with *S. alba*, the simultaneously published binomials of their respective hybrids with *S. salicifolia*, i.e. *S. × rubella* Dippel and *S. × rosalba* Dippel, are to be treated as synonymous. *S. × rosalba* is selected as having priority. *S. latifolia* is accepted at varietal rank, as *S. alba* var. *latifolia* (Aiton) Dippel, and its hybrid with *S. salicifolia* is recognized as *S. × rosalba* Dippel nothovar. **rubella** (Dippel) Silverside, **comb. et stat. nov.**

INTRODUCTION

In my key to the taxa of *Spiraea* sect. *Spiraea* naturalized in Britain (Silverside 1988), I alluded to difficulties regarding the correct binomials for the hybrids of the Eurasian species, *Spiraea salicifolia* L., with the North American species, *S. douglasii* Hook. and *S. alba* Du Roi (including *S. latifolia* (Aiton) Borkh.). Problems relate primarily to past interpretations of *S. salicifolia*, which was formerly understood to include *S. alba* and was consequently quoted as the parent of a number of hybrids which, in reality, involved the latter species. There is currently a need to establish the correct binomials for the hybrids discussed below.

SPIRAEA DOUGLASII × *S. SALICIFOLIA*

Spiraea × pseudosalicifolia Silverside, **hybr. nov.**
HOLOTYPE: Overhailes, near East Linton, East Lothian, Scotland, v.c. 82, hedge by River Tyne, 21 July 1973, *E. P. Beattie* (**E**).

Hybrida hortensis ex *Spiraea salicifolia* L. et *S. douglasii* Hook. exorta. Planta sterilis. Inflorescentiae cylindraceae usque peranguste conoideae. Folia anguste elliptica, basibus angustatis, apicibus subacutis vel acutis, serrata, infra obscure pubescentia saltem in venis principalibus.

Ad *S. salicifoliam* persimulans, maxime facile distinguibilis pubescentia foliari.

S. × pseudosalicifolia is widespread in Britain and is arguably our most common naturalized *Spiraea*. Like other members of this group it is commonly misidentified as *S. salicifolia*, a problem recognized by McClintock (1959). When distinguished from *S. salicifolia*, the hybrid has usually been recorded as *S. × billardii*. However, as was realized by Duvigneaud (1975), *S. × billardii* Hérincq is *S. alba* × *douglasii*. Reference to Hérincq's (1855) original description and plate shows that while he gave the parents of *S. × billardii* (originally spelt '*billardi*') as *S. douglasii* and *S. salicifolia*, the latter species was interpreted broadly, so as to include the North American *S. alba*. His plate shows a plant with a very broad, open panicle with more or less globose subpanicles. The leaves are broadly lanceolate and coarsely toothed, the toothing beginning some distance above the

leaf-base. The plant depicted was undoubtedly *S. alba* (probably var. *latifolia* (Aiton) Dippel) × *douglasii* subsp. *douglasii*.

S. douglasii × *salicifolia* seemingly has hitherto lacked a valid binomial. *S.* × *eximia* hort. ex K. H. E. Koch, *Dendrologie* **1**: 312 (1869), apparently refers to this taxon, but unfortunately the name is a later homonym of *S.* × *eximia* hort. ex Regel, *Ind. Seminum Hort. Bot. imper. Petropolitanus* **1866**: 107 (1866). Regel referred his taxon to *S. douglasii* × *hypericifolia* and his description certainly cannot refer to *S. douglasii* × *salicifolia*. In discussion of the hybrid of *S. douglasii* and *S. salicifolia*, Koch introduced *S.* × *eximia* along with the name *S. californica* hort. However, further on in his account, he clearly accepted the name *S. eximia* and his brief but adequate diagnosis of the hybrid must refer to this taxon. He expressed doubt about the nature of *S. californica*, of which he also gave a brief description, and Zabel (1893) and Dippel (1893) were most likely correct in referring the latter taxon to *S. alba* × *douglasii*, under the names *S. menziesii* Hook. var. *macrothyrsa* Zab. and *S.* × *macrothyrsa* Dippel respectively. Koch had a clear concept of the *S. alba* – *S. salicifolia* group and while I have not seen any material distributed by Koch as *S. eximia*, there seems no reason to doubt the application of the name. Nevertheless, it has seemed preferable to describe the hybrid afresh with a modern type specimen rather than base a nomen novum on Koch's limited description.

S. menziesii, treated by Zabel as *S. douglasii* × *salicifolia* (sensu lato), is best regarded as a glabrous or subglabrous subspecies of *S. douglasii*, i.e. *S. douglasii* subsp. *menziesii* (Hooker) Calder & Taylor. The name has been misapplied to some British collections. Zabel also described several varieties of *S. menziesii*, of which his var. *triumphans* may well have been the true *S. douglasii* × *salicifolia*. However, a new combination cannot be based on a name of less than certain application. The epithet '*triumphans*' has subsequently been frequently used for variants of *S.* × *billardii*.

The specimen chosen to be the type of *S.* × *pseudosalicifolia* represents the usual variant as I understand it, with leaves rarely exceeding 6 cm in length, inconspicuously pubescent beneath, at least on the main veins, generally similar in shape and toothing to those of *S. salicifolia* but more abruptly tapering to the often less acute apex. The foliar pubescence indicates that the *S. douglasii* parent was subsp. *douglasii*. The influence of *S. douglasii* is also often apparent in the slightly coarser toothing towards the leaf apex. The Perthshire material used to illustrate this hybrid (Fig. 1) is unfortunately in too poor a condition to serve as type material, but the specimen now selected as the type differs only in its somewhat more acute leaves. Pollen fertility of the type specimen has been estimated at 4.1%, based on examination of in excess of 1000 pollen grains from several anthers, using as the criterion the stainability of the contents of the pollen grains with acetocarmine, examined by Nomarski differential interference contrast microscopy (grey setting). Most grains taking up the stain were atypical in shape or size and the true viability of the pollen is likely to be substantially lower than this estimate.

Both *S.* × *billardii* and *S.* × *pseudosalicifolia* are naturalized in Britain, the former sometimes as var. *macrothyrsa* (Zabel) Duvigneaud. The two hybrids are not always reliably separable, but *S.* × *pseudosalicifolia* typically has smaller, narrower, more finely toothed leaves (Fig. 1) and narrower panicles. The majority of records for *S.* × *billardii* probably refer to *S.* × *pseudosalicifolia* and it would be better if reference to the true *S.* × *billardii* is confirmed by quotation of the hybrid formula.

SPIRAEA ALBA × *S. SALICIFOLIA*

Koch (1869) emphasized the extent to which *S. alba* and *S. salicifolia* had been crossed to give a range of garden hybrids and described the difficulty of distinguishing either of the parental species. This difficulty now applies to naturalized plants. *S. alba* var. *latifolia* (*S. latifolia* (Aiton) Borkh.) is naturalized in scattered localities throughout Britain, the majority of colonies being white-flowered. It is doubtful whether *S. alba* var. *alba* occurs in Britain, while European records appear to refer either to var. *latifolia* or perhaps to the hybrids discussed below. The two varieties of *S. alba* differ primarily in leaf shape, the leaves of var. *latifolia* being broader and more coarsely toothed (Fig. 2). The inflorescence branches of var. *alba* tend to be more pubescent and yellowish-brown whereas they are typically purplish-brown and subglabrous in var. *latifolia*. The petals of var. *alba* are

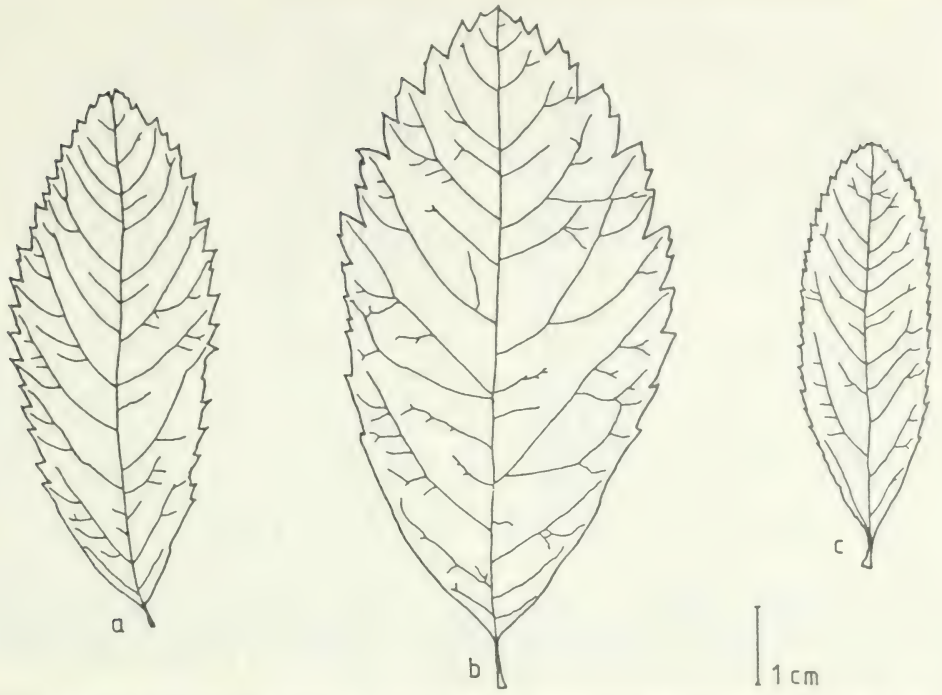

FIGURE 1. Leaves from flowering shoots. a. *Spiraea* × *billardii*, Newton of Ardtoe, Westerness, July 1981, *A. J. Silverside 1420*. b. *S.* × *billardii* var. *macrothyrsa*, Liskeard, Cornwall, July 1980, *A. J. Silverside 1123*. c. *S.* × *pseudosalicifolia*, Logierait, Perthshire, July 1980, *A. J. Silverside & E. H. Jackson 1077*. (All specimens **herb. A.J.S.**)

apparently always white, whereas those of var. *latifolia* vary from white to pale rose-pink. These characters are, however, variable and the usual modern treatment of these two taxa as conspecific appears justified. Further discussion is provided by Voss (1985). Var. *latifolia* may yet prove to be subspecifically distinct but it is here maintained at varietal rank.

Dippel (1893) published names for the hybrids of *S. salicifolia* with both *S. alba* [var. *alba*] and *S. alba* var. *latifolia*. As only one epithet can be legitimate and as Dippel published both names simultaneously, Article 57.2 of the International Code of Botanical Nomenclature requires that a choice be made between them. As I have not traced any such published decision, I select *Spiraea rosalba* Dippel as having priority over *Spiraea rubella* Dippel when *Spiraea alba* Du Roi and *Spiraea latifolia* (Aiton) Borkh. are treated as conspecific.

S. rubella still merits recognition at lower rank, in this case as a nothovariety:

Spiraea × **rosalba** Dippel, *Handbuch der Laubholzkunde* **3**: 484 (1893).

(a) *Spiraea* × *rosalba* Dippel nothovar. **rosalba**
This combination is automatically created as an autonym by publication of the following nothovariety (I.C.B.N., Article 26). Hybrid formula: *Spiraea alba* Du Roi var. *alba* × *S. salicifolia* L.

(b) *Spiraea* × *rosalba* Dippel nothovar. **rubella** (Dippel) Silverside, **comb. et stat. nov.**
Spiraea rubella Dippel, *Handbuch der Laubholzkunde* **3**: 484 (1893).
Hybrid formula: *Spiraea alba* Du Roi var. *latifolia* (Aiton) Dippel × *S. salicifolia* L.

As I have previously stated (Silverside 1988), these two nothovarieties are not easy to separate. Dippel distinguished them largely on the rather broader leaves and subglabrous inflorescence

FIGURE 2. Leaves from flowering shoots. a. *Spiraea alba* var. *latifolia*, Five Ashes, E. Sussex, 1980, *E. J. Rich* (**herb. A.J.S.**). b. *S. alba* var. *alba*, Saint-Janvier, Quebec, Canada, August 1940, *Marie-Victorin & Rolland-Germain 1921* (**E**). c. *S. salicifolia*, Nertschinsk, Siberia, 1889, *J. Dörfler* (**E**). d. *S. douglasii* subsp. *douglasii*, Langbank, Renfrewshire, July 1975, *A. J. Silverside 59* (**herb. A.J.S.**).

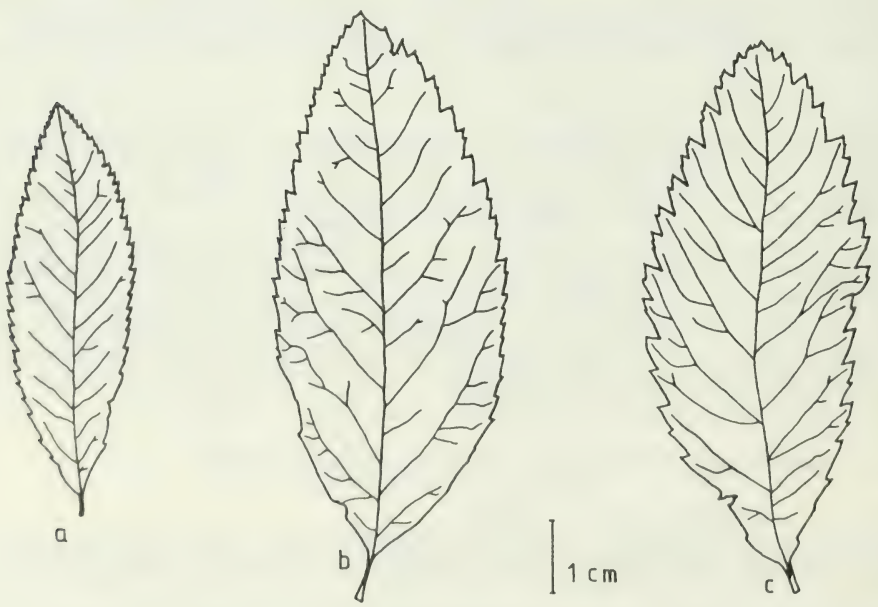

FIGURE 3. Leaves from flowering shoots. a. *Spiraea* × *rosalba* nothovar. *rosalba*, Dihewid, Cardigans., July 1982, *A. O. Chater*. b. *S.* × *rosalba* nothovar. *rubella*, Strath Oykel, E. Sutherland, August 1979, *A. J. Silverside & E. H. Jackson 734*. c. *S.* × *rosalba* nothovar. *rubella*, Ballintuim, Perthshire, August 1979, *A. J. Silverside 781*. (All specimens **herb. A.J.S.**)

branches of his *S. rubella*. Jørgensen (1973) used these same characters to distinguish naturalized plants in Norway, though he did not accept *S.* × *rubella* as a garden escape in that country. It must, however, be borne in mind that *S. salicifolia* is variable in the degree of pubescence of its inflorescence branches. In Britain, and apparently also in Europe, *S.* × *rosalba* (sensu lato) has been much confused with both parents. Nothovar. *rubella* is widely naturalized, especially in central Scotland and parts of Wales. Clones usually have compact but often broadly conical panicles, rose-pink flowers and rather broad, relatively coarsely toothed leaves, often with cuneate, entire bases (Fig. 3). As in the parents, the mature leaves are entirely glabrous, though very young leaves may have a few ciliate hairs on the margins or at the junction of the lamina and petiole. Limited examination of pollen in herbarium specimens (as described above) has given estimates of pollen fertility below 20%, though again the variability in size and shape of the pollen grains suggests that the true viability of the pollen must be substantially lower.

The status of nothovar. *rosalba* in Britain is less clear. As *S. alba* var. *alba* is morphologically closer to *S. salicifolia*, recognition of the hybrid is correspondingly more difficult. However, collections by A. O. Chater in 1982 from farm hedges at Dihewid and Pontsian in Cardigan (v.c. 46) appear to be referable to nothovar. *rosalba*. The specimens resemble *S. salicifolia* very closely; the lanceolate leaves are finely toothed, almost to the base, and the panicles are narrowly cylindrical. However, the panicles are a little more open than in much authentic *S. salicifolia* and the flowers were very pale pink in the living plants. Examination of the pollen has shown that these plants are almost completely sterile, in contrast to the high fertility (above 90%) shown by Eurasian specimens of *S. salicifolia*. Sax (1936) claimed very low pollen fertility in "*S. salicifolia*", but it seems reasonable to suppose that he was also working with hybrid material. As may be inferred from this discussion, the occurrence of true *S. salicifolia* in Britain must be regarded as highly doubtful; any confirmed record would justify published comment. Similar doubts about the occurrence of *S. salicifolia* apply in Belgium (Duvigneaud 1975) and West Germany (Adolphi & Nowack 1983).

REFERENCES

Adolphi, K. & Nowack, R. (1983). *Spiraea alba* Du Roi und *Spiraea* × *billardii* Hérinq, zwei häufig mit *Spiraea salicifolia* L. verwechselte taxa. *Gött. Flor. Rundbr.* **17**: 1–7.

Dippel, L. (1893). *Handbuch der Laubholzkunde* **3**: 462–497. Berlin.

Duvigneaud, J. (1975). Les Spiréoidées (Rosaceae subfam. Spiraeoideae) en Belgique et dans les régions voisines. *Natura Mosana* **28**: 33–55.

Hérincq, F. (1855). Les *Spiraea*. *Spiraea Billardi*. *L'Horticulteur Francaise* **1855**: 3–5 + plate 2.

Jørgensen, P. M. (1973). Forvillede arter og hybrider av slekten *Spiraea* i Norge. (Garden-escaped *Spiraea* species and hybrids in Norway). *Blyttia* **31**: 29–33.

Koch, K. H. E. (1869). *Dendrologie* **1**: 305–335. Erlangen.

McClintock, D. (1959). *Supplement to the pocket guide to wild flowers*. Platt.

Sax, K. (1936). Polyploidy and geographic distribution in *Spiraea*. *J. Arnold Arbor.* **17**: 352–356.

Silverside, A. J. (1988). *Spiraea* L., in Rich, T. C. G. & Rich, M. D. B., eds. *Plant crib*, pp. 46–48. London.

Voss, E. G. (1985). *Michigan Flora. II. Dicots (Saururaceae – Cornaceae)*. Michigan.

Zabel, H. (1893). *Die strauchigen Spiräen der deutschen Gärten*. Berlin.

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An assessment of populations of *Dactylorhiza traunsteineri* (Sauter) Soó in the British Isles and a comparison with others from Continental Europe

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ABSTRACT

The acceptance of *Dactylorhiza traunsteineri* (Sauter) Soó (Orchidaceae) as a British and Irish species has frequently been questioned. Twelve populations of dactylorchids from widely separate parts of the British Isles which have traditionally or recently been referred to this taxon, have been the subject of a critical morphometric evaluation. An inter-population comparison of the mean values of the key diagnostic characters indicated a degree of uniformity through the twelve populations although some geographical trends were identified. The data obtained were compared to, and found to be closely similar to those for populations of *D. traunsteineri* from the alpine region of Europe, including the type locality, and from Scandinavia, and this is offered as additional evidence for the inclusion of the species in the British and Irish floras. For *D. traunsteineri* in the British Isles, a comparison has been made with other dactylorchid taxa and their differences highlighted. The principal diagnostic characters of *D. traunsteineri* are summarised and a provisional distribution map is given.

INTRODUCTION

In a footnote to his *Flora* and under the name *Orchis Traunsteineri*, Reichenbach gave what was the first brief description of a species of marsh orchid from Kitzbühl, Austria, quoting Sauter as the authority (Reichenbach 1831). Shortly afterwards, Sauter himself provided a more detailed diagnosis of *O. traunsteineri* based upon similar Austrian specimens (Sauter 1837); in current nomenclature this is known as *Dactylorhiza traunsteineri* (Sauter) Soó.

Plants with characters corresponding to the description of continental *D. traunsteineri* were known in the British Isles as long ago as the last century, but were only first considered as such relatively recently (Heslop-Harrison 1953). Before and since then, however, their exact taxonomic status has been the subject of much speculation and various re-classifications have been attempted with treatments at varietal (Godfery 1933), subspecific (Pugsley 1936; Bateman & Denholm 1983) and specific level (in the latter case as *Orchis Traunsteinerioides* (Pugsley) Pugsley 1940). These treatments have been summarised by Roberts & Gilbert (1963), Tennant (1979), and Roberts (1988), and these workers along with others (Pugsley 1936; Heslop-Harrison 1953; Lacey 1955; Lacey & Roberts 1958) have also listed localities for similar dactylorchids. Morphometric studies of this taxon aimed at clarifying the situation have, in the British Isles, been restricted to the well-known Welsh populations (Cors Geirch, v.c. 49, and Cors Bodeilio, Rhos-y-gad, and Cors Erddreiniog (all v.c. 52)) (Lacey 1955; Lacey & Roberts 1958; Roberts 1966, 1988; Bateman & Denholm 1983), to one in Berkshire, v.c. 22 (Cothill), and also to three in Ireland, v.cc. H19, H20 and H23 (Heslop-Harrison 1953), and two small Yorkshire populations, v.cc. 62 and 64 (Roberts & Gilbert 1963) both of which are now almost extinct. Each of these independent studies has therefore covered only a very limited geographical range. Also, in addition to these differing views on taxonomic status, controversy has also arisen (Bateman & Denholm 1989; Roberts 1989) over the merits of the morphometric techniques employed, the interpretation of the data, and possible associated errors.

Within recent years, further populations referred to this taxon have been located in the British Isles, including several in Yorkshire, v.cc. 62 and 65 (Tennant *et al.* 1983; Foley 1986, 1989; Bolton & Horsman 1987; Tennant 1987), Norfolk, v.cc. 27 and 28 (Petch & Swann 1968; Swann 1975; F. Rose, pers. comm. 1988), Ireland, v.cc. H4, H5, H9 H16, H17, H18, H22, H26 and H29 (Scannell

1973; Webb & Scannell 1983; Curtis & McGough 1988; M. Keane, pers. comm. 1989), northern Wales, v.c. 49 (Roberts & Ward 1978), and scattered localities in southern England, v.cc. 6 and 12 (Rose 1975; Hedley 1987). Only very recently however, has it been confirmed from Scotland; Cunningham & Kenneth (1979) first tentatively identified as *D. traunsteineri*, a population of marsh-orchids from Kintyre, v.c. 101, but this was later refuted (Tennant & Kenneth 1983) when the plants were reassigned to *D. majalis* (Reichenb.) P. F. Hunt & Summerhayes subsp. *occidentalis* (Pugsl.) Sell. It was not until the discovery of a population very similar to *Orchis francis-drucei* Wilmott in W. Ross, v.c. 105, and its subsequent identification as *D. traunsteineri* (Lowe *et al.* 1986) that it was finally recognised from Scotland, although its presence there had been suspected for many years. Since then other populations have come to light (Kenneth *et al.* 1988), mostly very small and including some in Kintyre, but one larger Scottish population from W. Ross is known and is included in this study.

In a recent morphometric evaluation of British and Irish tetraploid marsh-orchids, which included two populations of this taxon from Anglesey, Bateman & Denholm (1983) assigned such plants to the new combination *D. majalis* subsp. *traunsteinerioides* (Pugsley) Bateman & Denholm. Roberts (1988), however, has shown that morphological data from one of these Anglesey populations compare well with those obtained by Reinhard (1985) for *D. traunsteineri* from the alpine region of continental Europe, and that separation of the Anglesey plants from these on the basis suggested by Bateman & Denholm (1983) cannot be justified. The present study, independently instigated, was already in progress prior to the publication of the work of Roberts (1988) and was undertaken in order to assess the degree of similarity or otherwise of various populations representing the full geographical range of the taxon in the British Isles. A morphometric examination of randomly selected plants has been made for each population, and data obtained compared with those for *D. traunsteineri* from the alpine region of Europe including the type locality. Comparisons have also been made with plants from Scandinavia, and with other British and Irish dactylorchids. This study therefore addresses two independent questions: (i) are British and Irish populations conspecific with continental *D. traunsteineri*, and (ii) should this taxon be considered at specific level or as a subspecies of some other dactylorchid, for example *D. majalis*?

POPULATIONS SAMPLED

A provisional map indicating the distribution of *D. traunsteineri* in the British Isles is given in Fig. 1. For the present study, evaluated populations have been selected as representative of the known range. Many of these have been discovered or identified only quite recently and have not been previously assessed morphometrically.

Details of the twelve British and Irish populations studied are given in Table 1. Other than at Booton (F) and Killinaboy (K), where the number of plants is small (approx 50), all are relatively strong populations often comprising several hundred flowering plants. This is significant particularly in the case of the Yorkshire sites, since the only previous morphometric study (Roberts & Gilbert 1963) carried out on similar plants from this area, was on colonies of total size nine and 22 plants respectively. Populations examined also include three which have previously been studied morphometrically (Heslop-Harrison 1953; Roberts 1966, 1988; Bateman & Denholm 1983). These are in Berks (v.c. 22) at Cothill (G), and in Anglesey (v.c. 52) at Cors Erddreiniog (H) and at Rhos-y-gad (I), and again all comprise a relatively large number of plants.

These twelve populations which are the subject of this study each occur in eutrophic, base-rich fens or flushes, some of which are quite small in area and are isolated. *Schoenus nigricans* L. is invariably present and grows in close association with these dactylorchids, whilst *Valeriana dioica* L., and where their distributional ranges allow, *Pinguicula vulgaris* L. and *Primula farinosa* L., are usually present also. Other associates can include *Carex lepidocarpa* Tausch, *Menyanthes trifoliata* L., *Epipactis palustris* (L.) Crantz, *Listera ovata* (L.) R. Br., and in Anglesey and Ireland, *Ophrys insectifera* L. Other dactylorchids are quite often absent, but *Dactylorhiza incarnata* (L.) Soó subsp. *incarnata* and subsp. *pulchella* (Druce) Soó sometimes occur nearby but not usually in direct association or intermixed with *D. traunsteineri*. *D. majalis* subsp. *purpurella* (T. & T. A. Steph.) Moore & Soó is a rarer associate, but subsp. *praetermissa* (Druce) Moore & Soó occurs at sites in southern and eastern England, whilst *D. fuchsii* (Druce) Soó and *D. maculata* (L.) Soó also occur

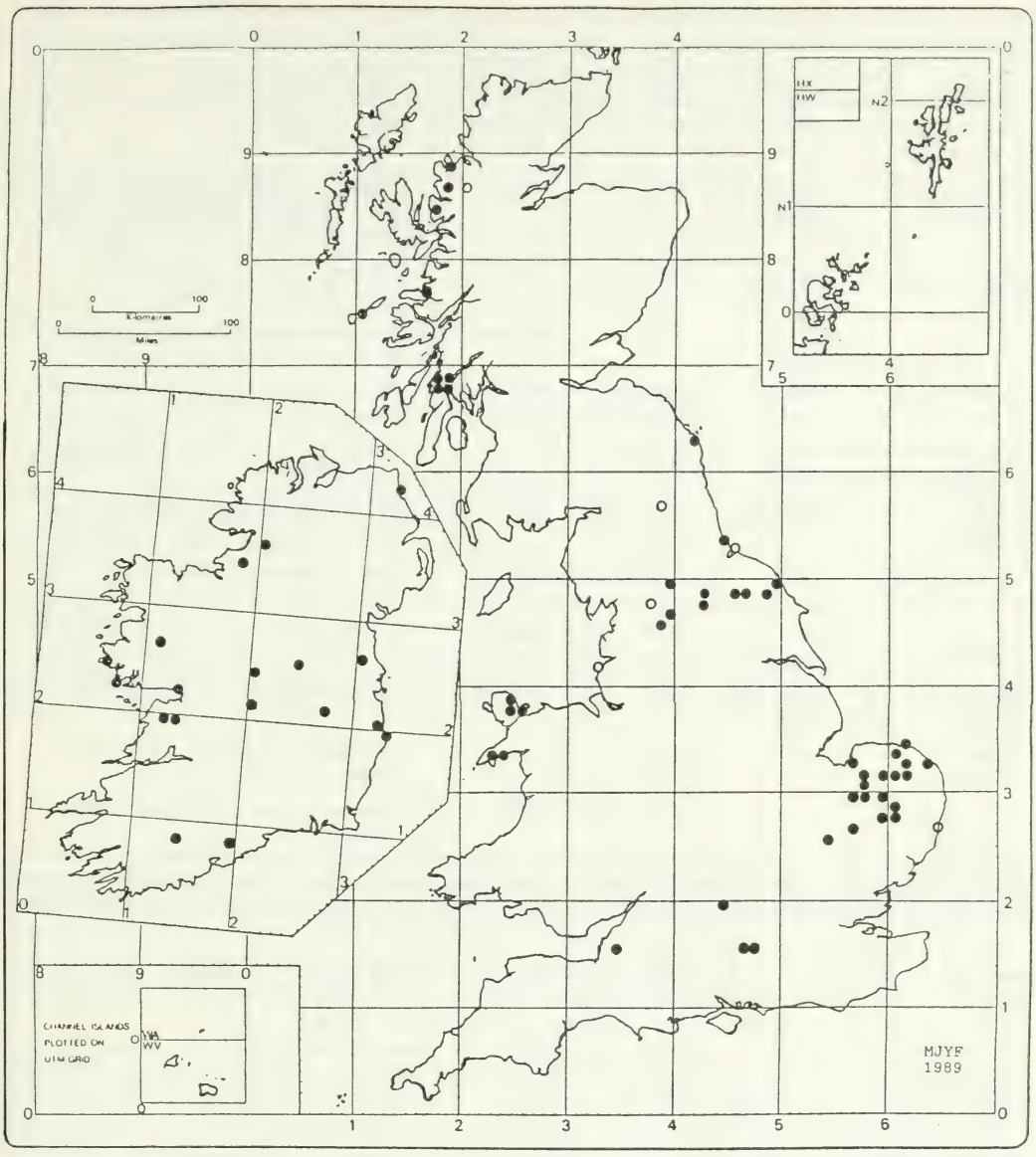

FIGURE 1. The distribution of *Dactylorhiza traunsteineri* in the British Isles plotted on a 10-km square basis (provisional). ● recorded sites; ○ doubtful or unconfirmed records.

within the general vicinity of most populations. Hybrids with other dactylorchids have been recorded by the author and others at several of the sites studied; the hybrid with *D. maculata* is known at Thornton Dale, Dalby Forest (Foley 1986), Cors Erddreiniog and Rhos-y-gad; that with *D. fuchsii* at the two Anglesey colonies; with *D. incarnata* at Wharfedale and again at the two Anglesey colonies; and with *D. majalis* subsp. *praetermissa* at the three sites in southern and eastern England. In all cases they are relatively infrequent and often very rare. No hybrids were found at Fylingdales although that with *D. fuchsii* may have been recorded here recently (Horsman 1989). In addition hybrids with the spotted orchids are suspected to occur at W. Ross, but no hybrids were

TABLE 1. BRITISH AND IRISH POPULATIONS OF *DACTYLORHIZA TRAUNSTEINERI* STUDIED

Population	Habitat	Grid Reference[a]	Number of plants	First record (if known)
Dalby Forest, v.c. 62 (A)	Fen	44/8—.8—	100–200	Foley (1986)
Thornton Dale, v.c. 62 (B)	Base-rich flushes	44/8—.8—	1000+	Originally thought to be *D. majalis* subsp. *purpurella* until redetermined by Tennant, Wright & Wright (1983)
Fylingdales, v.c. 62 (C)	Base-rich flush	44/9—.9—	500+	Old record recently rediscovered by Bolton & Horsman (1987)
Wharfedale, v.c. 64 (D)	Base-rich flush	34/9—.6—	300–500	Recorded here by P. M. Hall & W. A. Sledge in 1934. Also Pugsley (1935)
Beeston, v.c. 27 (E)	Fen	63/165.424	500+	Discovered by F. Rose, see Petch & Swann (1968)
Booton, v.c. 27 (F)	Fen	63/1—.2—	c. 50	Discovered by F. Rose (F. Rose, pers. comm. 1988)
Cothill, v.c. 22 (G)	Fen	41/461.998	100+	Known here for many years. See also Heslop–Harrison (1953)
Cors Erddreiniog, v.c. 52 (H)	Fen	23/475.821	1000+	Lacey & Roberts (1958)
Rhos-y-gad, v.c. 52 (I)	Fen/ meadow	23/510.788	100–200	Roberts (1960)
West Ross, v.c. 105 (J)	Base-rich flushes	18/7—.4—	500–1000	Discovered by M. R. Lowe in 1985
Killinaboy, v.c. H9 (K)	Fen	11/2—.9—	c. 50	Not known (M. Keane, pers. comm. 1989)
Kilmacduagh, v.c. H9 (L)	Fen	11/3—.9—	100+	Known for some years; see Webb & Scannell (1983)

[a] Owing to the fact some populations are in areas of very restricted access or are otherwise sensitive localities, full grid references are not always given. Full details are held by the author and by the Biological Records Centre.

observed at Killinaboy or Kilmacduagh although *D. majalis* subsp. *occidentalis* occurs in the vicinity. In all cases where mixed populations of dactylorchids occurred there was no difficulty in assigning plants to the correct taxon, or in recognising hybrids as such.

More than 85 localities have been recorded for *D. traunsteineri* in the British Isles, mostly restricted to calcareous fens and flushes. The plant exhibits a rather fragmented distributional pattern as can be seen from the provisional map (Fig. 1). However it has not been possible to examine specimens from all of the localities shown. Some populations occurring in Ireland have had their taxonomic status questioned (Webb & Scannell 1983) – as have many elsewhere – and it is not too clear how many Irish localities are still extant (Curtis & McGough 1988).

In the British Isles plants are normally in full flower in late May in western localities including Anglesey, and by early/mid-June inland, at higher altitudes, and to the north.

METHODS

Morphological characters were recorded from ten randomly selected plants in each population. The characters selected (and method of measurement), were in accord with those of other workers (Bateman & Denholm 1983; Roberts & Gilbert 1963; Roberts 1966, 1988), namely, plant height, total number of all developed and developing leaves (excluding the basal scale-like leaf which often decays), length of fully open inflorescence (from apex to the junction of the lowest flower with the

stem), the number of flowers in the inflorescence, and the maximum dimensions of the second leaf above the stem base (which is also usually the largest leaf). These characters were all measured on field material. At the same time the degree of leaf spotting was assessed (0 = absent, 1 = present) and the extent/distribution and size of the spots noted; an estimate was also made of the degree of anthocyanin staining of the upper stem and floral bracts (0 = absent, 1 = light, 2 = heavy). A single flower was removed from below the mid-point of each inflorescence, and from it, the maximum labellum width, the labellum length from the apex of the central lobe to the spur opening, the depth of the deeper inter-lobe sinus (if different) measured parallel to the vertical axis through the labellum from the base of the sinus to a point level with the apex of the adjacent lateral lobe, and the spur length from its tip to the junction with the labellum as well as the spur width at this point (with spur detached), were all obtained from flattened specimens which had been pressed within 48 hours of sampling. The shape of the labellum and the type and distribution of markings upon it were noted on similarly flattened specimens and also in the field.

The peripheral cells of a floral bract selected from below the mid-point of the inflorescence were also assessed for shape in profile and measured under microscopic examination (×100). In order to overcome any variation in shape and size of individual cells within and between bracts from the same and different plants, the total length of ten contiguous peripheral cells was measured at a point approximating to the mid-length on five separate bracts each from different plants within the population. The mean length and range of the cell lengths was calculated and any characteristic cell shapes noted. Any other distinct differences between populations which were readily apparent in the field, were also recorded, and at some localities, pH measurements were made on samples of surface water taken from within the immediate vicinity of the plants.

Results for most of the characters studied are recorded as population mean values, and where appropriate the standard error has also been calculated.

From the above measurements two further characters, floral density (number of flowers/cm of inflorescence length), and mean leaf index (second leaf from the base of the stem, mean length/mean (maximum) width) were calculated. All the data were obtained during the period 1985–1989.

RESULTS AND DISCUSSION

The main diagnostic characters of *D. traunsteineri* were given in some detail by Sauter (1837), viz: long narrow leaves, a lax, few-flowered inflorescence with relatively large flowers, each having a trilobed labellum. In addition other continental plants of *D. traunsteineri* have been described or illustrated as being typically slender, possessing relatively few, spotted or unspotted leaves, which are well-spaced along the stem, and with relatively broad labella (e.g. Landwehr 1977; Reinhard 1985; Kalteisen & Reinhard 1986; H. R. Reinhard, pers. comm. 1988).

VARIATION WITHIN THE BRITISH AND IRISH POPULATIONS STUDIED

For the populations studied, Table 2 lists data for the above-mentioned distinctive features. The mean length and shape of the peripheral cells of the floral bracts (character 19) are included in Table 3.

The average of the character means and the range which encompass the twelve British and Irish populations examined have been extracted from these data and are also given in Table 2 where it can be seen that there is close inter-population agreement in many key characters namely:–

(a) *Mean number of flowers per plant (character 3).* There is close agreement between most populations, falling within a narrow range 7·0–9·0; the slightly higher values for some populations (E–L), especially those from Ireland (K and L), reflects the presence of more robust plants at these sites.

(b) *Mean floral density (character 4).* Again there is good agreement throughout with little regional trend indicated. Inflorescences are variable in shape or very roughly cylindrical/tapering.

(c) *Mean total leaves per plant (character 5).* No significant regional trends were apparent, with good inter-population agreement. The mean number of non-sheathing leaves (character 6) is often considered to be a partially diagnostic character of *D. traunsteineri* (range 0–1) since the value for other British dactylorchids is much higher. Here, where known, the range is 0·6–1·0. In all cases it

TABLE 2. MEAN CHARACTER MEASUREMENTS AND STANDARD ERRORS (IN PARENTHESES) FOR TEN RANDOMLY SELECTED PLANTS IN EACH OF TWELVE POPULATIONS OF *DACTYLORHIZA TRAUNSTEINERI*

Character	A. Dalby Forest	B. Thornton Dale	C. Fyldingales	D. Wharfedale	E. Beeston	F. Booton	G. Cothill	H. Cor Erddreiniog	I. Rhos-y-gad	J. West Ross	K. Killinaboy	L. Kilmacduagh	Overall mean and range
1. Mean plant height (cm)	14·9 (1·04)	18·5 (1·28)	14·5 (0·62)	12·7 (0·63)	18·9 (1·06)	23·6 (1·47)	20·5 (2·05)	15·6 (0·41)	15·1 (1·09)	12·2 (0·56)	30·0 (1·41)	30·5 (1·45)	18·9 (12·2–30·5)
2. Mean length of inflorescence (cm)	3·4 (0·19)	3·4 (0·20)	3·4 (0·15)	3·4 (0·18)	4·0 (0·21)	4·93 (0·29)	4·2 (0·34)	3·9 (0·20)	4·0 (0·27)	3·4 (0·17)	4·6 (0·40)	5·5 (0·48)	4·0 (3·4–5·5)
3. Mean number of flowers	7·0 (0·53)	7·7 (0·45)	8·6 (0·89)	9·0 (0·37)	9·6 (0·85)	10·2 (1·07)	11·3 (1·30)	11·4 (0·99)	9·3 (0·74)	7·7 (0·74)	12·2 (1·45)	12·4 (1·76)	9·7 (7·0–12·4)
4. Floral density[a]	2·06 (—)	2·26 (—)	2·53 (—)	2·65 (—)	2·40 (—)	2·07 (—)	2·69 (—)	2·92 (—)	2·33 (—)	2·30 (—)	2·65 (—)	2·25 (—)	2·43 (2·06–2·92)
5. Mean total no. of leaves	3·3 (0·15)	3·5 (0·16)	3·8 (0·13)	3·9 (0·22)	4·0 (0·14)	3·5 (0·16)	3·7 (0·15)	3·4 (0·15)	3·7 (0·15)	3·5 (0·18)	3·3 (0·15)	3·7 (0·15)	3·6 (3·3–4·0)
6. Mean no. of non-sheathing leaves	0·9 (0·09)	0·6 (0·15)	0·7 (0·15)	0·8 (0·13)	0·9 (0·09)	0·7 (0·15)	1·0 (0·00)	0·9 (0·09)	0·6 (0·15)	0·8 (0·12)	0·9 (0·09)	0·8 (0·13)	0·8 (0·6–1·0)
7. Mean length of second leaf (cm)	7·60 (0·46)	8·35 (0·30)	7·55 (0·30)	5·70 (0·18)	9·84 (0·56)	10·00 (0·71)	9·13 (0·68)	8·10 (0·48)	7·97 (0·49)	5·00 (0·40)	13·95 (0·63)	14·37 (0·77)	8·96 (5·00–14·37)
8. Mean max. width of second leaf (cm)	1·04 (0·03)	1·10 (0·07)	0·83 (0·03)	1·03 (0·06)	0·93 (0·03)	1·01 (0·06)	1·00 (0·05)	1·10 (0·05)	1·03 (0·05)	0·91 (0·04)	1·09 (0·08)	1·14 (0·08)	1·02 (0·83–1·14)
9. Mean leaf index[b]	7·31 (—)	7·59 (—)	9·10 (—)	5·53 (—)	10·58 (—)	9·90 (—)	9·13 (—)	7·36 (—)	7·74 (—)	5·49 (—)	12·80 (—)	12·60 (—)	8·76 ((5·49)7·31–12·80)
10. Degree of leaf spotting[c]	0·3 (—)	0·1 (—)	0·0 (—)	0·5 (—)	0·0 (—)	0·0 (—)	0·1 (—)	0·0 (—)	0·0 (—)	0·0 (—)	0·1 (—)	0·8 (—)	0·2 (0·0–0·8)

TABLE 2 *cont'd*

Character	A. Dalby Forest	B. Thornton Dale	C. Fyllingdales	D. Wharfedale	E. Beeston	F. Booton	G. Cothill	H. Cor Erddreiniog	I. Rhos-y-gad	J. West Ross	K. Killinaboy	L. Kilmacduagh	Overall mean and range
11. Upper stem – anthocyanin staining[d]	0·5 (—)	1·5 (—)	1·0 (—)	1·5 (—)	0·7 (—)	0·2 (—)	0·8 (—)	1·0 (—)	0·8 (—)	1·0 (—)	0·2 (—)	0·6 (—)	0·8 (0·2–1·5)
12. Bracts – anthocyanin staining[d]	1·0 (—)	2·0 (—)	1·5 (—)	2·0 (—)	1·3 (—)	1·0 (—)	1·4 (—)	1·0 (—)	1·4 (—)	1·5 (—)	0·6 (—)	0·8 (—)	1·3 (0·6–2·0)
13. Mean labellum width (cm)	1·07 (0·04)	1·06 (0·02)	0·95 (0·02)	0·94 (0·04)	1·07 (0·03)	0·96 (0·04)	0·94 (0·03)	1·09 (0·05)	0·94 (0·03)	0·97 (0·03)	0·90 (0·02)	1·12 (0·06)	1·00 (0·90–1·12)
14. Mean labellum length (cm)	0·87 (0·03)	0·80 (0·02)	0·73 (0·02)	0·79 (0·02)	0·87 (0·03)	0·79 (0·03)	0·81 (0·03)	0·77 (0·04)	0·80 (0·03)	0·72 (0·02)	0·77 (0·01)	0·82 (0·04)	0·80 (0·72–0·87)
15. Mean spur width (cm)	0·36 (0·01)	0·32 (0·02)	0·34 (0·01)	0·32 (0·01)	0·31 (0·01)	0·30 (0·01)	0·31 (0·01)	0·33 (0·02)	0·32 (0·02)	0·29 (0·01)	0·28 (0·01)	0·31 (0·01)	0·32 (0·28–0·36)
16. Mean spur length (cm)	0·79 (0·02)	0·87 (0·02)	0·75 (0·01)	0·72 (0·03)	0·86 (0·03)	0·80 (0·03)	0·77 (0·03)	0·82 (0·04)	0·85 (0·02)	0·75 (0·04)	0·84 (0·02)	0·90 (0·03)	0·81 (0·72–0·90)
17. Mean sinus depth (mm)	0·36 (0·16)	0·89 (0·16)	0·85 (0·20)	0·78 (0·11)	0·70 (0·18)	0·47 (0·09)	0·32 (0·13)	1·10 (0·20)	0·92 (0·15)	1·17 (0·17)	0·27 (0·07)	0·77 (0·10)	0·72 (0·27–1·17)
18. Trilobed nature of labellum (or otherwise)	trilobed	distinctly trilobed	trilobed	distinctly trilobed	trilobed	trilobed to subrhomboidal	trilobed/subrhomboidal (very prominent central lobe)	distinctly trilobed	distinctly trilobed	distinctly trilobed (very prominent central lobe)	trilobed	trilobed	—

[a] Floral density = Character 3/Character 2.
[b] Mean leaf index = Character 7/Character 8.
[c] Degree of leaf spotting (always very light and about 1 mm diameter when present); 0 = absent, 1 = present.
[d] Degree of anthocyanin staining; 0 = absent, 1 = light, 2 = heavy.

TABLE 3. VARIATION IN BRACT PERIPHERAL CELLS OF *DACTYLORHIZA TRAUNSTEINERI* AND RELATED TAXA

Mean cell length and typical cell shape based upon ten contiguous peripheral cells from at least five bracts from separate plants in each population.

Species and population	Population mean cell length (μm), and range of means for individual bracts in parentheses		Typical cell shape in profile
D. traunsteineri (Britain and Ireland)			
A. Dalby Forest	98	(80–115)	elongated subacute to serrate
B. Thornton Dale	83	(80– 90)	,,
C. Fylingdales	85	(73–100)	,,
D. Wharfedale	74	(63– 80)	,,
E. Beeston	77	(65– 88)	,,
F. Booton	83	(70–108)	,,
G. Cothill	78	(65– 93)	,,
H. Cors Erddreiniog	93	(85–105)	,,
I. Rhos-y-gad	85	(68–100)	,,
J. W. Ross	88	(78–108)	,,
K. Killinaboy	85	(70– 98)	,,
L. Kilmacduagh	89	(78–100)	,,
D. traunsteineri (Continental Europe)			
Schwarzsee, Kitzbühl (Austria)	89	(80–112)	elongated subacute to serrate
Schmerikon, St. Gallen (Switzerland)	89	(78–103)	,,
Njurunda (Sweden)	76	(68–88)	,,
Visby (Sweden)	84	(70–103)	,,
D. incarnata subsp. *cruenta* (Ireland)			
Knockaunroe, v.c. H9	46	(40– 53)	rounded-crenate
D. incarnata subsp. *pulchella* (Cumbria)			
Milnthorpe, v.c. 69	56	(50– 58)	rounded-crenate
Sunbiggin Tarn, v.c. 69	46	(43– 50)	,,
D. majalis subsp. *purpurella* (Cumbria)			
Beckfoot, v.c. 70	69	(60– 80)	rounded-obtuse
Sandscale Haws, v.c. 69	68	(58– 78)	,,
Sunbiggin Tarn, v.c. 69	69	(55– 83)	,,
D. majalis subsp. *praetermissa* (England and Wales)			
Sandwich, v.c. 15	66	(58– 78)	rounded-obtuse
Elstead, v.c. 17	67	(58– 75)	,,
Kenfig, v.c. 41	57	(50– 65)	,,
D. majalis subsp. *occidentalis* (Ireland)			
Ballynaleckan, v.c. H9	78	(70– 85)	rounded-obtuse

was noted that leaves were well spaced along the stem and not crowded towards the base as is the case in some species of dactylorchid.

(d) *Mean leaf index of second leaf (character 9, incorporating characters 7 and 8).* The mean leaf index (length/maximum width of second leaf from stem base) showed some inter-population variation with the Wharfedale (D) population particularly low. Conversely the East Anglian populations (E and F) possessed relatively high values and the Irish (K and L) the highest of all, a character which is quite noticeable in the field. The Fylingdales plants (C) had the narrowest leaves (character 8) and showed little variation in width – this again was noticeable in the field. The mean maximum leaf width varied between 0·83–1·14 cm in the populations studied.

(e) *Degree of leaf spotting (character 10).* Leaf spots, when they occurred, were always small in size, about 1 mm diameter, solid, never densely distributed, and often spread over most of the upper surface of the leaf. In many plants in all populations spotting was absent, and in the samples examined, was not recorded from the Yorkshire population (C), nor from either of the East Anglian populations (E and F), nor those from Anglesey (H and I) (although recorded in a small proportion

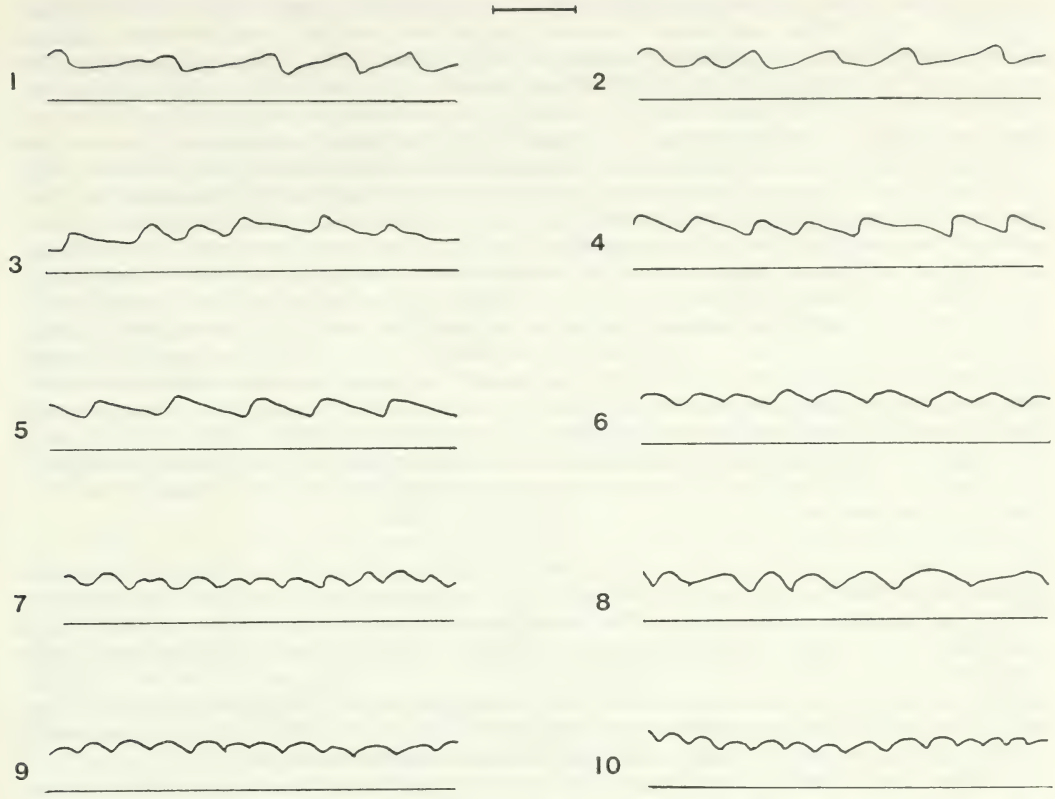

FIGURE 2. Profiles of peripheral cells of floral bracts (scale bar = 100 μm). 1. *D. traunsteineri* (Schmerikon, St. Gallen, Switzerland), 2. *D. traunsteineri* (Schwarzsee, Kitzbühl, Austria), 3. *D. traunsteineri* (Visby, Sweden), 4. *D. traunsteineri* (Thornton Dale, v.c. 62), 5. *D. traunsteineri* (Dalby Forest, v.c. 62), 6. *D. majalis* subsp. *purpurella* (Beckfoot, v.c. 70), 7. *D. majalis* subsp. *praetermissa* (Elstead, v.c. 17), 8. *D. majalis* subsp. *occidentalis* (Ballynaleckan, v.c. H9), 9. *D. incarnata* subsp. *pulchella* (Milnthorpe, v.c. 69), 10. *D. incarnata* subsp. *cruenta* (Knockaunroe, v.c. H9).

of the plants at colony I (Roberts 1960)), nor that from Scotland (J). In contrast, two Yorkshire colonies (A and D) were extensively leaf-spotted as was one of the Irish populations (L).

(f) *Mean labellum width (character 13) and mean labellum length (character 14).* Taken together these two characters showed no significant inter-population trend although five, Dalby Forest (A), Thornton Dale (B), Beeston (E), Cors Erddreiniog (H), and Kilmacduagh (L), had the greatest mean labellum widths. In all cases labella were slightly to semi-reflexed along the vertical axis.

(g) *Mean depths of sinuses and trilobed nature of labellum (characters 17 and 18).* This composite character was partly assessed subjectively on flattened specimens of labella from the plants sampled, together with measurements of inter-lobe sinus depths. The Anglesey populations (H and I) and that from W. Ross (J) could be separated from the others in being the most distinctly trilobed and possessing deeper inter-lobe sinuses (mean depth 0·92–1·17 mm), whereas the southern England populations (E, F and G) were trilobed/sub-rhomboidal with generally much less prominent sinuses (0·32–0·70 mm) and with the Cothill (G) and W. Ross (J) plants, especially, displaying very prominent central lobes. The Yorkshire populations had on average rather more pronounced sinuses (0·36–0·89 mm) than the southern plants. The Irish plants were somewhat variable and intermediate in this respect.

(h) *Bract peripheral cells – mean length and shape (character 19).* The shape in profile and length of

the peripheral cells of the floral bracts is known to vary between some species of dactylorchid (Hylander 1966). When such cells of various species and subspecies are examined under a magnification of ×100, it is readily apparent that, whilst these cells vary somewhat in shape and length even within the same bract, certain characteristics emerge when analysed as described above. The results for cell length measurements for various populations are given in Table 3 and typical cell shapes taken from photomicrographs are shown in Fig. 2. For the twelve British and Irish and four continental populations of *D. traunsteineri*, there was very close agreement in peripheral cell length and shape – these being typically elongated, subacute to serrate, angled in the direction of the bract apex, of mean length 63–115 μm (average 85 μm) and up to 65 μm in width. Populations of other species/subspecies of dactylorchids examined in the same manner were found to possess peripheral bract cells of a different shape and length; those of *D. majalis* subsp. *purpurella* and subsp. *praetermissa* were rounded-obtuse, shorter, mean length 50–83 μm and up to 50 μm in width, whilst for a population of subsp. *occidentalis* (Ballynaleckan, Co. Clare, v.c. H9), although rather longer (mean length 70–85 μm and up to 50 μm wide), were of similar shape to subsp. *purpurella* and subsp. *praetermissa*. Two subspecies of the diploid *D. incarnata* – subsp. *pulchella* and subsp. *cruenta* – had even shorter cells, mean length 40–58 μm and up to 35 μm wide, and were characteristically rounded-crenate giving a beaded appearance to the bract edge. Whilst it is stressed that there is some variation in shape and size within and between bracts from both the same and different plants in all taxa, nevertheless a clear overall picture emerges, and they can be used as characters to identify *D. traunsteineri* and separate it from other dactylorchids.

(i) *Other characters*

(1) Upper stem and bracts – anthocyanin staining (characters 11 and 12). These two characters appear to be related, with the bracts being invariably more strongly pigmented than the upper stem. Whilst this character is semi-subjective, it was found nevertheless that the Yorkshire plants (A, B, C and D) were on the whole the most deeply anthocyanin stained, with the Irish plants (K and L) the least so.

(2) Spur dimensions (characters 15 and 16). This would appear to be a less important character than those listed above. In all populations the spurs were relatively straight in lateral profile, especially on the under side, slightly curved on the upper and tapering to a blunt tip.

(3) Labellum colour and markings. Base colour varied between deep pink and light red-purple with markings of a similar much deeper colour. All the Yorkshire colonies (and especially C and D) were generally noticeably deeper in base colour than the others and marked overall by many small spots and flecks. On the other hand the Anglesey plants (H and I) were much lighter in base colour yet marked with much more contrasting heavier semi-continuous lines and blotches, and the Irish plants (K and L) possessed a very characteristic lilac-pink base colour. The remaining populations (E, F and G) were similar in base colour to the Anglesey plants but much more lightly and less contrastingly marked.

The degree of variation in all major characters between the populations studied is relatively small and throughout there is good agreement between the results presented here and those for the same populations studied by previous workers, e.g. Roberts (1988).

Regional differences may be summarised as follows:–

The Yorkshire plants (A, B, C and D) have fewer flowers of a deeper base colour with labella relatively finely marked, and with a proportion of plants with lightly spotted leaves. The upper stem and bracts are invariably strongly stained with anthocyanin. Other populations of similar plants have been given varietal status by Godfery (1933) as *Orchis latifolia* var. *eborensis*, and more recently as *D. majalis* subsp. *traunsteinerioides* var. *eborensis* by Bateman & Denholm (1983). The latter imply that such plants are always leaf marked, such marks more often than not being annular in shape, that inflorescences have often more than eight flowers, and that labella rarely exceed more than 7·5 × 9·5 mm, often more or less as broad as long and with a base colour only occasionally dark. Such diagnostic characters for the Yorkshire plants are not upheld in this study, and although there is some regional variation as outlined above, this appears to be within acceptable limits, and suggests that a separate varietal status may not be justified. Furthermore as Roberts & Gilbert (1963) acknowledge, in the two very small and isolated Yorkshire populations which they studied, there may have been appreciable genetic deviation from the norm, and the results now obtained seem to confirm this.

The southern England populations (E, F and G) have longer narrow leaves (high leaf index), with

labella trilobed to sub-rhomboidal, and relatively lightly coloured but not heavily spotted or loop marked.

Plants from the Anglesey populations (H and I) have much more lightly coloured flowers which are more heavily and contrastingly marked on the labella, these being distinctly trilobed, with relatively deep inter-lobe sinuses.

The Scottish population (J) comprises plants of small stature with relatively short leaves, and flowers which are markedly trilobed, with deep sinuses and a prominent central lobe.

Plants in both Irish populations (K and L) are relatively robust with a somewhat larger number of flowers in the inflorescence, these being a distinctive lilac-pink colour. They possess the highest leaf index of the populations examined and also have the longest leaves, and one population (L) has a high incidence of leaf-spotted plants; spurs are somewhat down-curved. Some of these characters agree closely with those possessed by plants in a population of *D. traunsteineri* from Njurunda, Sweden which is discussed in more detail below, and is thought to show some affinity to *D. russowii* (Klinge) J. Holub.

From examination of the above data, it is apparent that plants from the twelve populations included in this study, because of their relative geographical isolation from other populations of this taxon, understandably exhibit some inter-populational differences. Nevertheless, the populations show good agreement in the key diagnostic characters and it is therefore concluded that they should be treated as a single species, possibly with varietal status accorded to some Irish populations.

COMPARISON OF THE BRITISH AND IRISH POPULATIONS WITH DATA FOR *D. TRAUNSTEINERI* AT CONTINENTAL SITES

The average and range of the mean character measurements obtained for the twelve British and Irish populations taken together are included in Table 4. These are compared with data supplied by H. R. Reinhard of Zürich (pers. comm. 1989) for *D. traunsteineri* at the type locality, Schwarzsee, Kitzbühl, and with other composite data obtained by Reinhard for populations in Austria and Switzerland (Reinhard 1985) (note – data given by Kalteisen & Reinhard (1986) and described as "*locus classicus*" differ slightly from the Kitzbühl data since they also include plants from Zell am See, Salzburg). My observations and measurements on bract peripheral cells for *D. traunsteineri* populations from the British Isles and continental Europe are given in Table 3.

When the diagnostic characters 3, 4, 5, 8, 9, 13, 14, 18 and 19, are examined for British, Irish and continental European populations (Table 4), very close agreement is obtained in each case. In addition Reinhard (pers. comm. 1988) states that in plants from Austria and Switzerland the leaves can be either spotted or unspotted. The only significant difference lies in spur length which is found to be appreciably lower in this study (0·81 cm) than that found by Reinhard (1·11 cm and 1·09 cm). This is not a diagnostic character, but it is still surprising in view of the fact that Reinhard's data (Reinhard 1985) for spur length of *D. lapponica* (Laest. ex Hartman) Soó (0·78–0·96 cm), a taxon closely related to *D. traunsteineri*, are consistently lower and in close agreement with the present results. This difference from Reinhard's spur length data is also displayed in the results of Roberts (1988) and earlier workers. Nevertheless, the overall good agreement in the principal diagnostic characters supports the view of Roberts (1988) when concluding that the Rhos-y-gad plants (I) are indeed *D. traunsteineri*; similarly, the conclusion is now drawn that the British and Irish populations covered in this study are also conspecific with *D. traunsteineri*. However, if further work shows that British and Irish populations differ in some small respect from continental ones (e.g. as in spur length above), then the former should be placed as a subspecies of *D. traunsteineri*.

Tables 3 and 4 also include the author's data for a dactylorchid population from Njurunda, Sweden. This, whilst acceptably complying with the diagnostic characters for *D. traunsteineri*, nevertheless possesses some features applicable to the relatively elusive and rather vaguely described *D. russowii*, recorded for the Baltic area of Scandinavia and north-eastern Europe. This latter is a robust plant with a relatively long, rather dense-flowered inflorescence with a large number of flowers, each with comparatively small labellum dimensions, somewhat down-curved spurs, and with leaves quite heavily spotted and blotched. The Njurunda population occurs in neutral to slightly calcareous conditions (pH 6·9) growing with *Epipactis palustris*, the only locality for the latter in northern Sweden (R. Lidberg, pers. comm. 1989). Again most characters of the British populations agree well, and those from Ireland, (mean number of flowers, floral density, spur shape) especially so. Further work might show that *D. russowii* itself warrants consideration

only as a variety or subspecies of *D. traunsteineri*, possibly intergrading with the type, with the Njurunda population representing an intermediate variant. Morphometric data have also been obtained for a further population of *D. traunsteineri* from Visby, Gotland, Sweden which shares some similar characters with the Njurunda plants (inflorescence length, number of flowers). In the Visby plants, labella are slightly trilobed to sub-rhomboidal often with a prominent central lobe; the mean dimensions (n = 10) for labella are 0·96 cm (wide) × 0·79 cm, and for flattened spurs, 0·30 cm (wide) × 0·88 cm, with the floral bracts appreciably anthocyanin-stained (mean value 1·5). These data again agree closely with those for British and Irish populations, and fall well within the range of their appropriate character means.

As already commented, *D. traunsteineri* in the British Isles is usually restricted to calcareous fens and flushes with an approximate pH range 7·0–7·5, although it can occur in slightly acidic conditions as at Fylingdales (pH 6·5). Its existence in calcareous habitats is also the case at many sites in the alpine region of continental Europe and in Scandinavia where its associates can include calcicoles such as *Eriophorum latifolium* Hoppe and *Schoenus ferrungineus* L. (Simonsson & Lindström 1977; Jonsell 1982; Devillers-Terschuren & Devillers 1986). *D. traunsteineri* is also recorded from calcareous fens in the Haute-Marne area of north-eastern France growing with *Schoenus nigricans*, *S. ferrugineus*, and *Epipactis palustris* (Tyteca 1981), and from calcareous coastal fens in Pas-de-Calais (F. Rose, pers. comm. 1989). Records for *D. traunsteineri* from somewhat acidic habitats in continental Europe suggest a tolerance to such, possibly as a specialised ecotype of the species. Other records from distinctly acidic localities may be a result of confusion with a similarly described, taller, relatively narrow-leaved but more dense-flowered taxon accorded specific status as *D. sphagnicola* (Höppner) Soó. This latter has been recognised within the geographical range of *D. traunsteineri*, and has been recorded for West Germany (Rube 1972), for Belgium and north-eastern France (Tyteca 1986), for Sweden (Birkedal & Danielson 1981; Ericsson 1982), and is also claimed to occur along with the taxon described as *D. traunsteineri* subsp. *curvifolia* (Nyl.) Soó in eastern Finland (Räsänen & Saari 1987). It is known to inhabit acidic habitats as shown by such associates as *Juncus acutiflorus* Ehrh. ex Hoffm., *Drosera rotundifolia* L., and *Erica tetralix* L. (Landwehr 1977; Tyteca 1981).

Illustrations of continental *D. traunsteineri* closely similar to plants encountered in this study are given by Landwehr (1977) (see p. 159, nos. 1–5), as well as others in the same work from Ireland (p. 166, nos. 1–2). However those shown by him as *D. traunsteinerioides* (Pugsl.) Landw. (p. 166, nos. 3–5) from the same Irish locality are not typical of British and Irish plants, being much more dense-flowered and robust and are possibly of hybrid origin. A series of colour photographs of examples of *D. traunsteineri* from various sites in Switzerland and in Austria have been provided by H. R. Reinhard, and all show a very close similarity to plants from British and Irish populations. In addition, Reinhard has examined detailed colour photographs of typical plants from the British and Irish populations studied and has confirmed that all agree very well with *D. traunsteineri* from Kitzbühl – "Alle Ihne Bilder stimmen recht gut mit *D. traunsteineri* von Kitzbühel überein".

COMPARISON OF THE BRITISH AND IRISH POPULATIONS OF *D. TRAUNSTEINERI* WITH OTHER DACTYLORCHIDS

In Britain and Ireland, dactylorchids which may occasionally bear a superficial similarity to *D. traunsteineri* are the various subspecies of *D. majalis*:– subsp. *occidentalis*, subsp. *purpurella*, and sometimes subsp. *praetermissa*, and also and in particular, *D. incarnata* subsp. *pulchella*. Occasionally *D. incarnata* subsp. *cruenta* can exist in a form somewhat similar to *D. traunsteineri*.

Comparative mean characters for *D. majalis* subsp. *purpurella* from populations in Cumbria (v.cc. 69 and 70) and for subsp. *praetermissa* from S. Lancs (v.c. 59), are included in Table 5, and can be seen to differ from the principal diagnostic characters of *D. traunsteineri* which are indicated in column 2. (It should be emphasised that not all the characters shown in Table 5 are useful in separating *D. traunsteineri* from the various subspecies of *D. majalis*.) *D. majalis* subsp. *occidentalis*, as observed in western Ireland, also differs noticeably from *D. traunsteineri* particularly with respect to flower density, leaf number and shape, and in having significantly greater maximum leaf width; it also differs in spur shape, and all three subspecies of *D. majalis* differ from *D. traunsteineri* in that they possess leaves which are relatively crowded towards the base of the stem. Bract peripheral cell data (Table 3) also help separate *D. traunsteineri* from these taxa.

D. incarnata subsp. *pulchella* is readily separated from *D. traunsteineri* by its denser inflorescence

TABLE 4. COMPARISON OF DATA FOR THE TWELVE POPULATIONS (BRITISH ISLES) OF *DACTYLORHIZA TRAUNSTEINERI* STUDIED HERE WITH THOSE FROM EUROPEAN LOCALITIES

For each character, means are given together with either the standard error or range in parentheses.

Character	Twelve populations (A–L) from the British Isles	Schwarzsee, Kitzbühl, Austria (*locus classicus*) n = 13 (data ex Reinhard, pers. comm. 1989)	Composite data from eight separate European populations n = 75 (data ex Reinhard 1985)	Måckelmyra, Njurunda, Sweden n = 10 (author's data)
1. Mean plant height (cm)	18·9 (12·2–30·5)	22·4 (0·96)	24·7 (0·53)	25·7 (1·07)
2. Mean length of inflorescence (cm)	4·0 (3·4–5·5)	4·7 (0·23)	4·7 (0·13)	5·0 (0·22)
3. Mean number of flowers	9·7 (7·0–12·4)	8·3 (0·35)	8·4 (0·27)	13·5 (0·83)
4. Floral density[a]	2·43 (2·06–2·92)	1·77 (—)	1·78 (—)	2·68 (—)
5. Mean total no. of leaves	3·6 (3·3–4·0)	4·1 (0·20)	4·0 (0·07)	3·7 (0·14)
6. Mean no. of non-sheathing leaves	0·8 (0·6–1·0)	nd	nd	0·7 (0·14)
7. Mean length of second leaf (cm)	8·96 (5·0–14·37)	10·20 (0·29)	9·03 (0·24)	10·33 (0·38)
8. Mean max. width of second leaf (cm)	1·02 (0·83–1·14)	0·77 (0·02)	1·00 (0·03)	1·06 (0·07)
9. Mean leaf index[a]	8·76 ((5·49)7·31–12·80)	13·25 (—)	9·01 (—)	9·75 (—)
10. Degree of leaf spotting[a]	0·2 (0·0–0·8)	0·54 (0·14)	nd	1·0 (0·00)
11. Upper stem – anthocyanin staining[a]	0·8 (0·2–1·5)	nd	nd	0·6 (0·12)
12. Bracts – anthocyanin staining[a]	1·3 (0·6–2·0)	nd	nd	1·1 (0·11)
13. Mean labellum width (cm)	1·00 (0·90–1·12)	1·00 (0·04)	1·06 (0·01)	0·90[b] (0·02)
14. Mean labellum length (cm)	0·80 (0·72–0·87)	0·76 (0·02)	0·77 (0·01)	0·68[b] (0·02)
15. Mean spur width (cm)	0·32 (0·28–0·36)	0·27[d] (0·01)	0·26[d] (0·00)	0·25[c] (0·01)
16. Mean spur length (cm)	0·81 (0·72–0·90)	1·11 (0·03)	1·09 (0·01)	0·80[b] (0·04)
17. Mean sinus depth (mm) from tip of lateral lobe (where available)	0·72 (0·27–1·17)	nd	nd	0·50[b] (0·13)
18. Trilobed nature of labellum (or otherwise)	usually distinctly trilobed, occasionally approaching sub-rhomboidal, dotted lined or flecked	distinctly trilobed with lines, flecks and loops	distinctly trilobed with sinuses, occasionally sub-rhomboidal, with lines, flecks and loops	more or less trilobed

[a] See Table 2 for an explanation of these characters.
[b] n = 19.
[c] n = 17.
[d] True diameter (not flattened).
nd = No data available.

TABLE 5. COMPARISON OF TWELVE POPULATIONS (BRITISH ISLES) OF *DACTYLORHIZA TRAUNSTEINERI* WITH BRITISH POPULATIONS OF *D. MAJALIS* SUBSP. *PURPURELLA* AND SUBSP. *PRAETERMISSA*

For each character, means are given together with either the standard error or range in parentheses.

Character	Character importance[a]	*D. traunsteineri* Twelve populations (A–L)	*D. majalis* subsp. *purpurella* Beckfoot, v.c. 70 (35/0.5)	*D. majalis* subsp. *purpurella* Sunbiggin Tarn, v.c. 69 (35/6.0)	*D. majalis* subsp. *purpurella* Sandscale Haws, v.c. 69 (34/1.7)	*D. majalis* subsp. *praetermissa* Longton, v.c. 59 (34/4.2)
1. Mean plant height (cm)	–	18·9 (12·2–30·5)	13·7 (0·55)	17·1 (0·75)	9·4 (0·49)	40·1 (2·66)
2. Mean length of inflorescence (cm)	–	4·0 (3·4–5·5)	5·2 (0·24)	4·6 (0·29)	3·9 (0·17)	8·5 (0·53)
3. Mean number of flowers	+	9·7 (7·0–12·4)	>30[c] (—)	>25[c] (—)	>20[c] (—)	>40[c] (—)
4. Floral density[b]	+	2·43 (2·06–2·92)	>5·77 (—)	>5·43 (—)	>5·12 (—)	>4·73 (—)
5. Mean total no. of leaves	+	3·6 (3·3–4·0)	5·8 (0·19)	5·8 (0·19)	6·3 (0·20)	7·2 (0·28)
6. Mean no. of non-sheathing leaves	+	0·8 (0·6–1·0)	1·0 (0·00)	1·8 (0·19)	1·1 (0·09)	2·4 (0·29)
7. Mean length of second leaf (cm)	–	8·96 (5·00–14·37)	8·31 (0·27)	7·90 (0·25)	5·97 (0·30)	14·35 (0·67)
8. Mean max. width of second leaf (cm)	+	1·02 (0·83–1·14)	2·34 (0·10)	1·71 (0·06)	1·69 (0·10)	3·97 (0·17)
9. Mean leaf index[b]	+	8·76 ((5·49)7·31–12·80)	3·55 (—)	4·62 (—)	3·53 (—)	3·61 (—)

TABLE 5 *cont'd*

Character	Character importance[a]	*D. traunsteineri* Twelve populations (A–L)	*D. majalis* subsp. *purpurella* Beckfoot, v.c. 70 (35/0.5)	*D. majalis* subsp. *purpurella* Sunbiggin Tarn, v.c. 69 (35/6.0)	*D. majalis* subsp. *purpurella* Sandscale Haws, v.c. 69 (34/1.7)	*D. majalis* subsp. *praetermissa* Longton, v.c. 59 (34/4.2)
10. Degree of leaf spotting[b]	–	0·2 (0·0–0·8)	1·0 (—)	0·0 (—)	0·3 (—)	0·1 (—)
11. Upper stem – anthocyanin staining[b]	+/–	0·8 (0·2–1·5)	0·5 (—)	0·6 (—)	0·6 (—)	<0·5 (—)
12. Bracts – anthocyanin staining[b]	+/–	1·3 (0·6–2·0)	0·5 (—)	1·0 (—)	1·0 (—)	<0·5 (—)
13. Mean labellum width (cm)	+/–	1·00 (0·90–1·12)	0·86 (0·03)	0·84 (0·03)	0·81 (0·02)	1·27 (0·03)
14. Mean labellum length (cm)	–	0·80 (0·72–0·87)	0·64 (0·02)	0·66 (0·02)	0·62 (0·02)	0·86 (0·02)
15. Mean spur width (cm)	–	0·32 (0·28–0·36)	0·34 (0·01)	0·32 (0·01)	0·28 (0·01)	0·32 (0·02)
16. Mean spur length (cm)	–	0·81 (0·72–0·90)	0·81 (0·01)	0·80 (0·03)	0·69 (0·02)	0·92 (0·02)
18. Trilobed nature of labellum (or otherwise)	+/–	usually distinctly trilobed, occasionally approaching sub-rhomboidal, dotted, lined or flecked	more or less rhomboidal, sometimes slightly trilobed	more or less rhomboidal, sometimes slightly trilobed	more or less rhomboidal, sometimes slightly trilobed	rhomboidal/ trilobed

[a] The usefulness of characters in separating *D. traunsteineri* from the taxa listed in Table 6; + = useful, +/– = partially useful, – = not useful.
[b] See Table 2 for an explanation of these characters.
[c] Difficult to determine precisely without destroying the inflorescence.

TABLE 6. CHARACTERS OF *DACTYLORHIZA TRAUNSTEINERI* COMPARED WITH OTHER BRITISH AND IRISH *DACTYLORHIZA* TAXA

Although individual plants may sometimes lie outside the limits given, the mean values for an analysis of 10+ randomly selected plants in any colony should conform to most of these criteria; + = agrees with description, +/− = borderline for description, − = disagrees with description. All data based upon the author's field measurements and observations except where shown.

		Dactylorhiza traunsteineri					*D. majalis* subsp. *occidentalis*	*D. majalis* subsp. *purpurella*	*D. majalis* subsp. *praetermissa*	*D. incarnata* subsp. *pulchella*	*D. incarnata* subsp. *cruenta*
Character	Description	All British & Irish populations examined (A–L)	Kitzbühl (*locus classicus*)[a]	Alpine localities (European) – eight populations[a]	Måckelmyra, Njurunda, Sweden[b]	Visby, Gotland, Sweden	Ballynaleckan v.c. H9	Sunbiggin Tarn v.c. 69	Longton v.c. 59	Milnthorpe v.c. 69	Knockaunroe v.c. H9
No. of flowers	Few-flowered – from 7 to maximum of 14 per inflorescence	+	+	+	+	+	+/−	−	−	+/−	+/−
Floral density	Lax inflorescence – less than 3 flowers (mean) per cm of inflorescence length	+	+	+	+	+	−	−	−	−	−
No. of leaves	Leaves well-spaced along stem, total maximum of 4	+	+	+	+	+	−	−	−	+/−	−
Leaf width	Maximum width largest leaf 1·20 cm	+	+	+	+	+	−	−	−	−	−
Leaf shape/ spotting	Leaves unspotted or lightly spotted, linear-lanceolate, largest leaf at least 5·5× longer than wide (usually 7×–14×)	+	+	+	+[c]	+	−	−	−	+/−	−[d]

TABLE 6 *cont'd*

Character	Description	*Dactylorhiza traunsteineri*					*D. majalis* subsp. *occidentalis*	*D. majalis* subsp. *purpurella*	*D. majalis* subsp. *praetermissa*	*D. incarnata* subsp. *pulchella*	*D. incarnata* subsp. *cruenta*
		All British & Irish populations examined (A–L)	Kitzbühl (*locus classicus*)[a]	Alpine localities (European) – eight populations[a]	Måckelmyra, Njurunda, Sweden[b]	Visby, Gotland, Sweden	Ballynaleckan v.c. H9	Sunbiggin Tarn v.c. 69	Longton v.c. 59	Milnthorpe v.c. 69	Knockaunroe v.c. H9
Bract colouration	Bracts often noticeably anthocyanin-stained	+	+	+	+	+	–	+	–	+	–[e]
Labellum width	Labellum at least 0·90 cm wide	+	+	+	+	+	+	–	+	–	–
Labellum shape	Labellum usually trilobed, often with prominent, elongated central lobe, and noticeable sinuses	+	+	+	+	+/–	+	–	–	–	–
Spur shape	Spur thick, robust and more or less horizontal, and only slightly tapering	+	+	+	–	+	–	–	+/–	–	–
Bract cells	Bract peripheral cells elongated sub-acute to serrate (typical mean length 60–115 μm, average 85 μm)	+	+	+	+	+	–	–	–	–	–

[a] Details for populations in Switzerland and Austria are ex Reinhard (1985), and H. R. Reinhard, pers. comms. 1988, 1989. Some live material supplied by H. R. Reinhard and F. Wischmann.
[b] Affinity to *D. russowii*.
[c] Leaves often heavily spotted.
[d] All leaves heavily spotted on both surfaces.
[e] Bracts spotted but not typically stained.

(often 20 or more flowers per plant and floral density >5 flowers/cm of inflorescence), its relatively small, strongly reflexed, and not noticeably trilobed labella (mean 0·67 cm wide × 0·56 cm long (details from Milnthorpe, v.c. 69)), relatively broad leaves, and again and most characteristically, by the rounded-crenate and consistently shorter peripheral cells of the floral bracts (Table 3). This latter character is an effective method of separating all subspecies of *D. incarnata* from *D. traunsteineri*. *D. incarnata* subsp. *cruenta* is also readily separated on characters similar to those which separate subsp. *pulchella* from *D. traunsteineri*.

In Table 6, based mainly upon data obtained by the author, the key characters useful in identifying British and Irish *D. traunsteineri* are applied to various other dactylorchids as well as to *D. traunsteineri*. From this, the latter is clearly shown to be separate from the other dactylorchids.

CONCLUSIONS

The mean values for the principal characters of the twelve British and Irish populations examined were found to be similar, although some regional trends could be detected. Whilst individuals within any population may deviate appreciably from the typical variant, generally populations exhibit a uniformity in diagnostic characters, particularly the characters of floral density, leaf index, maximum leaf width and labellum width. The data obtained for all populations were very close to those recorded for continental *D. traunsteineri*, including plants at the type locality. Also, when these data were compared to those for populations of other dactylorchid taxa, clear differences were found. It is therefore concluded that plants from the British Isles are conspecific with *D. traunsteineri* from the classic localities of continental Europe, and should be retained at specific rank and not placed under *D. majalis* as suggested by Bateman & Denholm (1983).

SYNONYMY

Dactylorhiza traunsteineri (Sauter) Soó, *Nom. nov. gen. Dactylorhiza* 6 (1962). *Orchis Traunsteineri* Sauter ap Reichenbach, *Flora Germ. Exc.* (1831). *Orchis latifolia* L. var. *eborensis* Godfery, *Mon. Icon. Br. nat. Orchidaceae* 219 (1933). *O. majalis* Reichenbach subsp. *Traunsteinerioides* Pugsley in *Proc. Linn. Soc. Lond.* **148**: 124 (1936). *O. Francis-Drucei* Wilmott in *Proc. Linn. Soc. Lond.* **148**: 128 (1936). *O. majalis* Reichenbach subsp. *traunsteinerioides* Pugsley var. *eborensis* (Godfery) Pugsley in *J. Bot., Lond.* **77**: 54 (1939). *O. traunsteinerioides* (Pugsley) Pugsley in *J. Bot., Lond.* **78**: 179 (1940). *Dactylorchis traunsteineri* (Sauter) Vermeulen, *Stud. Dactyl.* 66 (1947). *Dactylorchis traunsteinerioides* (Pugsley) Vermeulen, *Stud. Dactyl.* 66 (1947). *Dactylorhiza traunsteineri* (Sauter) Soó subsp. *traunsteinerioides* (Pugsley) Soó, *Nom. nov. gen. Dactylorhiza* 6 (1962). *D. traunsteineri* (Sauter) Soó subsp. *francis-drucei* (Wilmott) Soó, *Nom. nov. gen. Dactylorhiza* 6 (1962). *D. traunsteinerioides* (Pugsley) Landwehr in *Orchideeën* **37**: 80 (1975). *D. traunsteineri* (Sauter) Soó subsp. *hibernica* Landwehr in *Orchideeën* **37**: 79 (1975). *D. majalis* (Reichenbach) P. F. Hunt & Summerhayes subsp. *traunsteinerioides* (Pugsley) Bateman & Denholm in *Watsonia* **14**: 372 (1983). *D. majalis* subsp. *traunsteinerioides* var. *traunsteinerioides* Bateman & Denholm in *Watsonia* **14**: 373 (1983). *D. majalis* subsp. *traunsteinerioides* var. *eborensis* Bateman & Denholm in *Watsonia* **14**: 373 (1983). *D. majalis* subsp. *traunsteinerioides* var. *francis-drucei* Bateman & Denholm in *Watsonia* **14**: 373 (1983).

DESCRIPTION

The principal diagnostic features of populations of *D. traunsteineri* in the British Isles are summarised as:–

Variable in height (12–30 cm tall), distinctly slender in appearance, often with flexuous stems. Leaves few (usually 3–4 including 0–1 non-sheathing leaf), narrow, linear-lanceolate, strict to occasionally subarcuate, usually more than 7× as long as broad, (second lowest (usually also largest) leaf 8–12 mm at maximum width), well-spaced out along the stem, unspotted or lightly spotted (spots solid, c. 1 mm diameter). The inflorescence is often rather variable in shape or roughly cylindrical/tapering, often subsecund, few-flowered (usually 7–12) and distinctly lax, the flowers coloured deep pink/red-purple, relatively large with ± semi-reflexed, broad (c. 10 mm) labella which are flecked and loop-marked in a similar but much deeper colour, usually distinctly trilobed, sometimes with a pronounced central lobe. The floral bracts and upper stem are often

stained red-brown with anthocyanin, and the peripheral cells of these bracts are characteristically elongated, sub-acute to serrate, 60–115 μm in mean length. Plants are in full flower from late May to mid-June, and are usually found in calcareous fens and flushes.

A provisional distribution map of *D. traunsteineri* in the British Isles (Fig. 1) is included, but it is very likely that further field work will lead to a consolidation of its distributional pattern. Colour photographs of plants, samples of pressed and mounted labella, spurs and bracts of the plants examined, photomicrographs of bract peripheral cells, and site details of the populations studied, are all retained by the author.

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REFERENCES

Bateman, R. M. & Denholm, I. (1983). A reappraisal of the British and Irish Dactylorchids, 1. The tetraploid marsh-orchids. *Watsonia* **14**: 347–376.

Bateman, R. M. & Denholm, I. (1989). Morphometric procedure, taxonomic objectivity and marsh-orchid systematics. *Watsonia* **17**: 449–455.

Birkedal, S. & Danielson, J. (1981). Första fyndet av Mossnycklar (*Dactylorhiza sphagnicola*) i Skåne. *Svensk bot. Tidskr.* **75**: 313–314.

Bolton, J. H. & Horsman, F. (1987). Botanical records for 1985. *Naturalist, Hull* **112**: (No. 980) 25.

Cunningham, M. H. & Kenneth, A. G., eds. (1979). *The flora of Kintyre*. Wakefield.

Curtis, T. G. F. & McGough, H. N. (1988). *The Irish red data book. 1. Vascular plants*. Dublin.

Devillers-Terschuren, J. & Devillers, P. (1986). Distribution et systématique du genre *Dactylorhiza* en Belgique et dans les régions limitrophes. *Naturalistes belg.* **67**: 143–155.

Ericsson, B. C. (1982). Mossnycklar och skogsfru växter på Öland. *Svensk bot. Tidskr.* **76**: 1–4.

Foley, M. J. Y. (1986). *Dactylorhiza maculata* (L.) Soó × *D. traunsteineri* (Sauter) Soó in N. E. Yorks. *Watsonia* **16**: 175–176.

Foley, M. J. Y. (1989). *Dactylorhiza traunsteineri* (Sauter) Soó: variants in north-east Yorkshire. *Watsonia* **17**: 355–356.

Godfery, M. J. (1933). *Monograph and iconograph of native British Orchidaceae*. Cambridge.

Hedley, S. (1987). Plant records. *Watsonia* **16**: 450.

Heslop-Harrison, J. (1953). Studies in *Orchis* L., II. *Orchis traunsteineri* Saut. in the British Isles. *Watsonia* **2**: 371–391.

Horsman, F. (1989). Botanical Report for 1987. *Naturalist, Hull* **114**: 51.

Hylander, N. (1966). *Nordisk Kärlväxtflora* **2**: vii. Stockholm.

Jonsell, B. (1982). Ångsnycklar och sumpnycklar i nordligaste Uppland. *Svensk bot. Tidskr.* **76**: 103–111.

Kalteisen, M. & Reinhard, H. R. (1986). Orchideen in zentralen italienischen Südalpenraum. *Mitt. bl. Arbeitskr.-Heim. Orch., Baden-Württ.* **18**: 1–136.

Kenneth, A. G., Lowe, M. R. & Tennant, D. J. (1988). *Dactylorhiza lapponica* (Laest. ex Hartman) Soó in Scotland. *Watsonia* **17**: 37–41.

Lacey, W. S. (1955). *Orchis traunsteineri* Saut. in Wales. *Proc. bot. Soc. Br. Isl.* **1**: 297–300.

Lacey, W. S. & Roberts, R. H. (1958). Further notes on *Dactylorchis traunsteineri* (Saut.) Vermeul. in Wales. *Proc. bot. Soc. Br. Isl.* **3**: 22–27.

Landwehr, J. (1975). Het geslacht *Dactylorhiza*. *Orchideeën* **37**: 76–80.

Landwehr, J. (1977). *Wilde orchideeën van Europa*. Vol. 1. Amsterdam.

Lowe, M. R., Tennant, D. J. & Kenneth, A. G. (1986). The status of *Orchis francis-drucei* Wilmott. *Watsonia* **16**: 178–180.

Petch, C. P. & Swann, E. L. (1968). *Flora of Norfolk*. Norwich.

Pugsley, H. W. (1935). On some marsh orchids. *Bot. J. Linn. Soc.* **49**: 553–592.
Pugsley, H. W. (1936). New British marsh orchids. *Proc. Linn. Soc. Lond.* **148**: 121–125.
Pugsley, H. W. (1939). Recent work on dactylorchids. *J. Bot., Lond.* **77**: 50–56.
Pugsley, H. W. (1940). Further notes on British dactylorchids. *J. Bot., Lond.* **78**: 177–181.
Räsänen, J. & Saari, H. (1987). Kaitakämmekän (*Dactylorhiza traunsteineri*) muuntelusta Pohjois-Karjalassa. *Lutukka* **3**: 35–39.
Reichenbach, H. G. L. (1831). *Flora Germanica Excursoria*, p. 140. Lipsiae.
Reinhard, H. R. (1985). Skandinavische und Alpine *Dactylorhiza*-Arten (*Orchidaceae*). *Mitt. Bl. Arbeitskr.-Heim. Orch., Baden-Württ.* **17**: 321–416.
Roberts, R. H. (1960). The Wicklow marsh orchid in Anglesey. *Nature Wales* **6**: 14–17.
Roberts, R. H. (1966). Studies on Welsh orchids. III. The coexistence of some tetraploid species of marsh orchids. *Watsonia* **6**: 260–267.
Roberts, R. H. (1988). The occurrence of *Dactylorhiza traunsteineri* (Sauter) Soó in Britain and Ireland. *Watsonia* **17**: 43–47.
Roberts, R. H. (1989). Errors and misconceptions in the study of marsh-orchids. *Watsonia* **17**: 455–462.
Roberts, R. H. & Gilbert, O. L. (1963). The status of *Orchis latifolia* var. *eborensis* Godfery in Yorkshire. *Watsonia* **5**: 287–293.
Roberts, R. H. & Ward, S. D. (1978). Plant records. *Watsonia* **12**: 177.
Rose, F. (1975). Plant records. *Watsonia* **10**: 433.
Rube, G. (1972). *Dactylorhiza sphagnicola* (Höppner) Soó in der Lüneburger Heide. *J. ber. naturw. Ver. Wuppertal.* **25**: 138–139.
Sauter, J. (1837). *Flora* **20**: Beilbl. 3.
Scannell, M. J. P. (1973). *Dactylorhiza traunsteineri* (Sauter) Soó in east Cork, mid Cork, Offaly, Meath, Leitrim and east Mayo. *Ir. Nat. J.* **17**: 426.
Simonsson, P. & Lindström, B. M. (1977). Myrar i västra Ramsele, Ångermanland. *Svensk bot. Tidskr.* **71**: 419–428.
Swann, E. L. (1975). *Supplement to the Flora of Norfolk*. Norwich.
Tennant, D. J. (1979). *Dactylorhiza traunsteineri* in Yorkshire. *Naturalist, Hull* **104**: 9–13.
Tennant, D. J. (1987). Plant records. *Watsonia* **16**: 450.
Tennant, D. J. & Kenneth, A. G. (1983). The Scottish records of *Dactylorhiza traunsteineri* (Sauter) Soó. *Watsonia* **14**: 415–417.
Tennant, D. J., Wright, B. & Wright, A. (1983). Plant records. *Watsonia* **14**: 431.
Tyteca, D. (1981). Observations sur quelques *Dactylorhiza* de Belgique et du nord de la France. *Bull. Soc. r. Bot. Belg.* **114**: 15–30.
Tyteca, D. (1986). Observations orchidologiques en Belgique et dans les territoires voisins: bilan 1981–1985. *Dumortiera* **34–35**: 107–111.
Vermeulen, P. (1947). *Studies on dactylorchids*. Utrecht.
Webb, D. A. & Scannell, M. J. P. (1983). *Flora of Connemara and the Burren*. Cambridge.
Wilmott, A. J. (1936). New British marsh orchids. *Proc. Linn. Soc. Lond.* **148**, 126–130.

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Displacement of *Elodea canadensis* Michx by *Elodea nuttallii* (Planch.) H. St John in the British Isles

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ABSTRACT

Elodea nuttallii (Planch.) H. St John has spread rapidly since its introduction into the British Isles in 1966. A feature of its spread has been its displacement of *E. canadensis* Michx in places where the latter was well established. One possible reason is that *E. nuttallii* is able to achieve more rapid stem elongation, as well as produce a greater number of axillary stems over a given period of time, resulting in *E. canadensis* eventually being shaded out of a locality. Cultivation experiments suggested that stem elongation and axillary stem production was significantly ($P<0{\cdot}001$) greater in *E. nuttallii* under nutrient-poor and -rich conditions and a range of light intensities. Stem elongation in *E. nuttallii* appeared to be most rapid immediately after establishment, while in *E. canadensis* there was a gradual elongation as time progressed. These characteristics may lead to more rapid formation of a canopy of stems and leaves by *E. nuttallii* at or near the water surface, a factor which may help to bring about the eventual displacement of *E. canadensis* in many places.

INTRODUCTION

Elodea canadensis Michx and *E. nuttallii* (Planch.) H. St John are native to North America, but as adventive species they have become widely distributed around the British Isles. *E. canadensis* has long been established, but *E. nuttallii* was first recorded in 1966, since when it has spread rapidly. An interesting feature of its spread was its apparent displacement of *E. canadensis* in many localities where the latter species had been well established. This was observed by a number of workers (cf. Briggs 1977; Lund 1979; Simpson 1984) who noted that *E. nuttallii* more-or-less replaced *E. canadensis* over a period of one or two years, with only a few plants of the latter remaining after this time.

The speed of displacement initially led to suggestions that *E. nuttallii* was a phenotypic variant of *E. canadensis*, although this has been disproved (Simpson 1988). Nevertheless the displacement of *E. canadensis* appears to be continuing and, indeed, personal observations made in southern England over the past two years suggest that here, at least, *E. canadensis* is now much less common than *E. nuttallii*. However it should be noted that there are some sites where there seems to be little competition between the two species, and others where *E. canadensis* is still the only species present.

A number of incidental observations were also made on material of both species which had been planted at the same time in a nutrient-rich substrate in a large tank. Within three to four weeks of planting *E. nuttallii* had become well-established, producing many stems, whereas *E. canadensis* remained short and more or less decumbent with comparatively few stems being produced. *E. canadensis* remained in a similar condition throughout the growing season, while *E. nuttallii* continued to produce stems in quantity. One possible reason for the displacement of *E. canadensis* in natural habitats is that *E. nuttallii* is able to achieve more rapid stem elongation, as well as produce a greater number of axillary stems over a given period of time, with the result that *E. canadensis* may eventually be shaded out. To examine this in more detail, three cultivation experiments were carried out in which stem elongation and production of axillary stems were measured in both species under differing environmental conditions.

MATERIALS AND METHODS

Material was collected from the Lancaster-Kendal Canal, Burton-in-Kendal, Westmorland, v.c. 69 (*E. canadensis*) and R. Lune, Skerton, Lancaster, v.c. 60 (*E. nuttallii*) in August 1983. The three experiments, also carried out in August 1983, were as follows:

(i) 5 cm long apical stem sections of each species were planted in a 5 cm deep, nutrient-poor coarse sand/gravel mixture, which had been put into six 30 cm diameter, 40 cm deep polypropylene bins. 15 stem sections of each species were planted in each bin. The bins were placed in pairs in a glasshouse where supplementary illumination was provided by 20 Atlas 'Daylight' fluorescent tubes, giving a maximum light intensity of 250 μmol $m^{-2}s^{-1}$. The lights were set to give a 16 hour photoperiod and temperature was maintained at 22±5°C. Ten plants of each species were harvested on each date and immediately pressed. Stem length, together with the number of axillary stems produced by each plant, were recorded after 10, 20 and 30 days. Analyses of variance were carried out on species data for each harvesting date.

(ii) Plants were grown at four surface light intensity levels, 250 (high), 35 (medium), 2 (low) and 0 μmol $m^{-2}s^{-1}$. Otherwise, culture methods were similar to those in experiment (i). Ten plants of each species were grown at each light intensity. After 35 days stem length and the number of axillary stems per plant were recorded. Analyses of variance were carried out on stem length data between species at each light intensity.

(iii) Similar to experiment (ii) except the plants were grown in nutrient-rich river sediment.

RESULTS AND DISCUSSION

The results of experiment (i) are shown in Fig. 1. *E. canadensis* showed almost no stem elongation after ten days, and had grown to only about 7 cm after 30 days. Conversely, *E. nuttallii* showed a marked amount of stem elongation after ten days, when the mean stem length was 9·5 cm. By 20 days mean stem length was 12·5 cm, and this was followed by a further, although smaller increase after 30 days. The difference in stem length between the two species was highly significant ($P<0·001$) on each sampling date. A similar rate of stem elongation in *E. nuttallii* was noted by Kunii (1982).

The results of experiments (ii) and (iii) are shown in Fig. 2 and Table 1. As expected, no plants

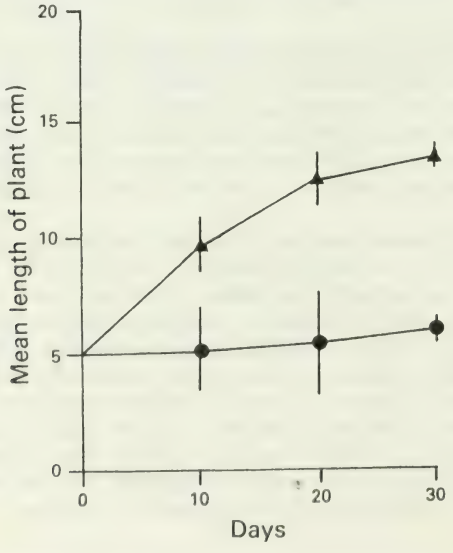

FIGURE 1. Growth of *Elodea canadensis* (●) and *E. nuttallii* (▲) under conditions of constant temperature, light intensity and photoperiod.

survived in total darkness. Otherwise both species demonstrated greater stem elongation in nutrient-rich substrate, and again, this was expected considering the impoverished nutrient regime provided by the coarse sand/gravel mixture. However in both experiments *E. nuttallii* showed significantly ($P<0{\cdot}001$) greater stem elongation than *E. canadensis* after 30 days at the two lower intensities. In material growing on nutrient-poor sand/gravel this difference was greatest at medium light intensity, but in plants growing on nutrient-rich river sediment it was greatest at high light intensity. The number of axillary stems per plant decreased in both species with decreasing light intensity in both substrate regimes. However at medium and high light intensities the number of branches was considerably higher in *E. nuttallii*, again in both substrate regimes.

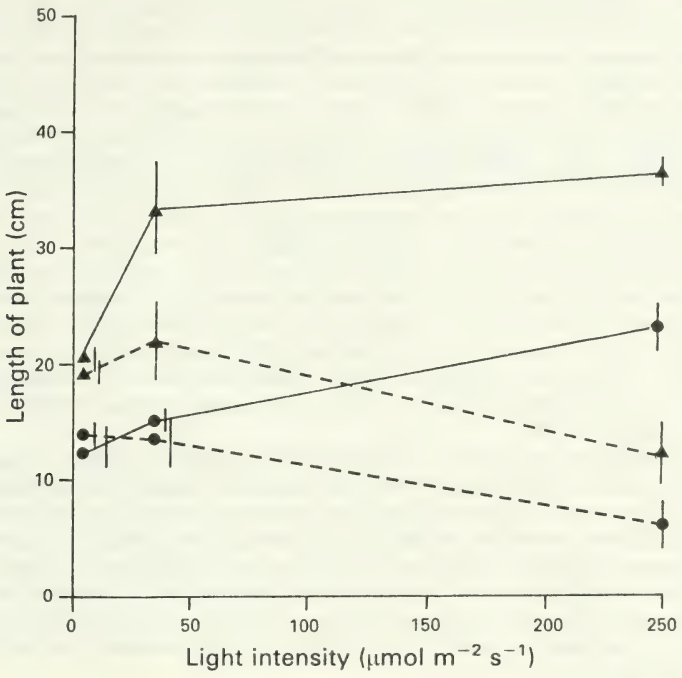

FIGURE 2. Growth of *Elodea canadensis* (●) and *E. nuttallii* (▲) after 30 days at differing light intensities in nutrient-poor (- -) and nutrient-rich (—) subtrates.

The data from experiment (i) also suggest that stem elongation in *E. nuttallii* is most rapid in the period immediately after establishment, while in *E. canadensis* there is only a gradual elongation as time progresses. As only nutrient-poor substrate was used in this experiment, it could be argued *E.*

TABLE 1. MEAN NUMBER OF AXILLARY STEMS PER PLANT ON *ELODEA CANADENSIS* MICHX AND *ELODEA NUTTALLII* (PLANCH.) H. ST JOHN AFTER 30 DAYS GROWTH ON NUTRIENT-POOR AND -RICH SUBSTRATES UNDER THREE DIFFERING LIGHT INTENSITIES

Substrate type	Light intensity	*E. canadensis* (mean±SE)	*E. nuttallii* (mean±SE)
Nutrient-poor	low	1·00±0·001	1·00±0·001
	medium	1·00±0·01	3·00±0·01
	high	1·00±0·001	5·00±0·01
Nutrient-rich	low	1·00±0·001	1·00±0·001
	medium	1·75±0·001	3·25±0·01
	high	8·75±0·02	11·00±0·01

canadensis might show more rapid stem elongation on nutrient-rich substrate. However experiment (iii) suggests that, even when nutrient-rich substrate is used, *E. nuttallii* is still capable of faster growth.

Although these experiments are by no means exhaustive, they do suggest that *E. nuttallii* has a greater rate of stem elongation and axillary stem production over a given period of time. One way in which these could be related to the displacement of *E. canadensis* is in the formation of a canopy. Canopy formation is of particular importance to submerged macrophytes which, because of the light attenuating properties of water, often grow in low light intensities. One of the main problems for such plants is to obtain sufficient light for photosynthesis, and to overcome this they concentrate photosynthetic tissue towards the water surface, as near as possible to the light (Barko & Smart 1981). In shallow water this results in the formation of a canopy at the water surface which is composed of a large number of densely crowded stems and leaves. Such a feature is characteristic of *Elodea* and related genera. An important feature of the canopy is that light levels below it are much reduced. This was amply demonstrated in *Hydrilla verticillata* (L.f.) Royle by Haller & Sutton (1975) who recorded a 95% reduction in light intensity under a canopy of this species. The effect of this would be to shade out other species present in the same habitat. Canopy production confers an obvious advantage as it severely restricts the competitive ability of other species (Haller & Sutton 1975; Titus & Adams 1979; Barko & Smart 1981). The implications of this are that if stem elongation and axillary stem production is more rapid in *E. nuttallii*, this species may produce a canopy more quickly than *E. canadensis* and thereby shade out the latter.

In deep water, aquatic plants are often unable to elongate to the water surface (Barko *et al.* 1982) and they do not produce a canopy of the type described above. Nevertheless a canopy may still be formed, although in this case it consists of longer, less densely crowded stems and leaves. Again, the formation of a canopy may be more rapid in *E. nuttallii*. This is supported by observations made in Mitchell Wyke Bay, Windermere where *E. nuttallii* rapidly displaced *E. canadensis* (Lund 1979), although both species grow at depths of up to 3 m or more and never reach more than 1·35 m below the water surface (Simpson 1983).

The results obtained from experiment (i) may also be analogous to stem elongation occurring early in the growing season, which might be another significant factor in determining the success of *E. nuttallii* over *E. canadensis*. Assuming that both species commence active growth at the same time, stem elongation may proceed more rapidly in *E. nuttallii*; thus canopy formation in this species is already well advanced before *E. canadensis* is able to reach an equivalent stage. As a result, *E. canadensis* may only be able to survive in gaps within the stand of *E. nuttallii*, or on its fringes, through the remainder of the season. Observations in the field would seem to fit in with this hypothesis, since *E. canadensis* is usually seen in this type of situation when the two species are growing in the same habitat.

Incidental observations were also made of the time taken for new roots to appear on the stem pieces. This was faster in *E. nuttallii*, and the first roots were usually seen about four days after planting. Those of *E. canadensis* took about 10–14 days to appear. In the British Isles both *Elodea* species spread by vegetative means. The stems are brittle and, when small pieces of stem break away from the parent plant, roots often form at the nodes, allowing the piece to establish itself as a new plant. Thus *E. nuttallii* may have a further advantage over *E. canadensis* in being able to establish itself faster by rooting more quickly.

It should be emphasised that the experiments described were of a fairly simple nature, and that measurements were made after only a short period of cultivation. Therefore it is conceivable that some of the differences may have occurred due to prevailing conditions in the original habitats. Nevertheless, although more detailed and lengthy work is needed to confirm the results, they do shed some light on the problem under discussion. The reasons why *E. nuttallii* seems to be more vigorous than *E. canadensis* in some habitats and not others also need to be determined and would be worthy of further investigation.

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I thank Dr G. Halliday for his continued advice and encouragement throughout this work.

REFERENCES

BARKO, J. W. & SMART, R. M. (1981). Comparative influences of light and temperature on the growth of selected submersed freshwater macrophytes. *Ecol. Monogr.* **51**: 219–235.

BARKO, J. W., HARDIN, D. G. & MATTHEWS, M. S. (1982). Growth and morphology of submerged freshwater macrophytes in relation to light and temperature. *Can. J. Bot.* **60**: 877–887.

BRIGGS, M. (1977). *Elodea nuttallii. B.S.B.I. News* **15**: 9–10.

HALLER, W. T. & SUTTON, D. L. (1975). *Hyacinth Control J.* **13**: 48–50.

KUNII, H. (1982). The critical water temperature for the active growth of *Elodea nuttallii* (Planch.) St John. *Jap. J. Bot.* **32**: 111–112.

LUND, J. W. G. (1979). The mystery of *Elodea* Michx in Great Britain. *Watsonia* **12**: 338.

SIMPSON, D. A. (1983). *Experimental taxonomic studies of* Elodea *Michx in the British Isles*. Ph.D. thesis, University of Lancaster.

SIMPSON, D. A. (1984). A short history of the introduction and spread of *Elodea* Michx in the British Isles. *Watsonia* **15**: 1–9.

SIMPSON, D. A. (1988). Phenotypic plasticity of *Elodea nuttallii* (Planch.) H. St John and *Elodea canadensis* Michx in the British Isles. *Watsonia* **17**: 121–132.

TITUS, J. E. & ADAMS, M. S. (1979). Coexistence and comparative light relations of the submersed macrophytes *Myriophyllum spicatum* L. and *Vallisneria americana* Michx. *Oecologia* **40**: 273–286.

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Additions to the flora of Mull and adjacent small islands

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ABSTRACT

Vascular plant records, new to the modified 10-km squares used by the British Museum (Natural History) Survey of Mull and adjacent islands, made over the past ten years are listed. Thirty species and two hybrids of flowering plants, and one horsetail, are recorded as new to the archipelago, and two further species are confirmed. Eighteen species are recorded from the islands only for the second time, and eight species have been refound after a period of at least 40 years.

INTRODUCTION

The British Museum (Natural History) Survey of the Isle of Mull and adjacent small islands, carried out between 1966 and 1970, was published in 1978 (Jermy & Crabbe 1978). Between the time that the resulting Flora went to press and the end of 1988, when Joan Clark handed over the B.S.B.I. Recordership of v.c. 103, a number of vascular plant records have been made and are published here to chronicle the changes taking place in the flora of the island.

The authors are not in a position to assess the changes in land-use that will have altered the ecology of the island. However, a few comments can be made. Cottages on the island are frequently bought and lived in by people from the mainland, who often develop or expand the small gardens, and a number of alien plants are thus introduced and may escape to become established locally: e.g. *Ficus carica*, *Lysichiton americanus*, *Montia perfoliata*, *Poa chaixii*, *Sedum spurium* and *Soleirolia soleirolii*. Another recorded alien is the North American *Epilobium ciliatum*, the seed possibly having been brought in with other garden plants.

Forestry has taken its toll, like elsewhere in Western Scotland, and the maturation of trees in plantations has meant closer canopies and the elimination of a ground flora. The most serious change has been widespread planting by the Forestry Commission in the Coladoir River valley S.S.S.I., where the interesting bog complex has been divided and surrounded by trees. Similar large-scale planting on very wet mires in the Belat valley, Dervaig, will change the character of this extensive alluvial area which, although not outstandingly rich, is an area of floristic potential. With forestry planting comes the introduction of alien tree species, which may establish themselves locally and beyond. One such species, *Alnus incana* (L.) Moench, obviously planted in the Salen Forest around Loch Frisa (square 7), was recorded in 1979. Other species seen outside obviously planted areas, and possibly established from seed (or more likely planted by a landscape-conscious tenant/owner), and not hitherto recorded, are: *Larix kaempferi* (Lamb.) Carrière (11) Doire Darach, 1988, *Picea abies* (L.) Karsten (13) Rubha na Gall, 1987, *Pinus contorta* Douglas ex Loudon (11) Doire Darach, 1988, *Quercus cerris* L. (4) Ulva, 1987, *Salix calodendron* Wimmer (4) Ulva, 1983 and *Tsuga heterophylla* (Rafin.) Sarg. (11) Doire Darach, 1988.

The density of sheep is still very high, and numbers of deer similarly so (P. Wormell, pers. comm.). There appears to be little management of the number of deer within or across estates. Fewer sheep and deer, and more cattle, would improve the botanical richness. Fish-farming is

established in and around Mull, as elsewhere in western Scotland, the largest salmon-rearing unit being in Loch Spelve. The effect of this on the marine flora, and eventually on the littoral vegetation, is an unknown quantity.

The island has attracted a number of botanists, some on a regular basis, and a few resident, over the last ten years. This has resulted in 30 species and two hybrids of flowering plants (not including the trees listed above), and one horsetail (*Equisetum hymale*), being recorded as new to the area. A further 18 species, known previously from single records, have been recorded for the second time. Also of interest are the following species, refound after at least 40 years, or in need of confirmation for the island: *Barbarea vulgaris* (1879:1981), *Hypericum maculatum* subsp. *maculatum* (1889:1984), *Malva sylvestris* (1939:1977 & 1981), *Polygonum bistorta* (1879:1988), *Rubus radula* (1894:1984), *Silene alba* (1850:? 1945, confirmed 1987), *Spergularia rubra* (1877:? 1939, confirmed 1988) and *Pseudorchis albida* (1848:1988, refound in the area of Boswell-Syme's original locality).

In the following text, records new to the island are marked with an asterisk (*), and those recorded for a second time only with two asterisks (**). The order of the species (with the exception of *Rubus*, which follows Edees & Newton (1988)) follows Dandy (1958), with the later additions inserted appropriately. The system of modified 10-km square as used in the British Museum Survey is indicated throughout (in **bold** type). Voucher specimens, when available have been deposited in **BM** or **E** and indicated as such. Records made by Joan Clark are indicated by the initials JWC, and those made by Alan Stirling by AMcGS; other recorders' names are given in full.

SYSTEMATIC LIST

FERNS AND FERN ALLIES

Lycopodum clavatum L.: **7**. Speinne Mór, 1983, R. W. M. Corner. **10**. Beinn na Croise, 1983, R. W. M. Corner. **14**. Allt Mór Coire nan Eunachar, 1984, A. Kelham.

Diphasiastrum alpinum (L.) Holub: **7**. Speinne Mór, 1983, R. W. M. Corner. **10**. Beinn na Croise, 1980, A. Kelham.

Equisetum fluviatile L.: **4**. Ditch, Ulva, 1988, A. Walker.

E. hyemale L.: **6**. Ardow burn, 1986, M. North, **E**. First localized record.

Ophioglossum vulgatum L.: **4**. Three clumps in short turf at separate sites, Gometra, 1988, M. Jones.

Botrychium lunaria (L.) Swartz: **2**. Loch Staoineig, 1980, H. Rhodes. **3**. Ardalanish, 1984, A. Kelham. **11**. Abundant in grassland on sand and shingle shore, Loch Ba, 1988, G. Rothero; on southwestern slopes of Ben More, 1988, L. Farrell & R. Scott.

Cryptogramma crispa (L.) R.Br. ex Hook.: **8**. Creach Bheinn, 1979, A. Kelham, **BM**.

Asplenium adiantum-nigrum L.: Entry in Bangerter & Cannon (1978) should read **1–17**.

A. trichomanes subsp. *quadrivalens* D. E. Meyer emend. Lovis: **4**. Farm dyke, Ulva, 1982, JWC. **14**. Rock crevice, Garmony, 1981, JWC, **BM**. **17**. Rock crevice, Leckruah, 1983, JWC.

A. ruta-muraria L.: **14**. Old chapel, Pennygown, 1981, JWC.

Cystopteris fragilis (L.) Bernh.: **17**. Port na Tairbeirt and south of Grass Point, 1984, AMcGS.

Polystichum aculeatum (L.) Roth: **17**. Woodland, Auchnacraig, 1988, A. Walker & E. Stewart.

P. setiferum (Forsk.) Woynar: **7**. Above Loch Frisa, 1983, R. W. M. Corner.

Dryopteris filix-mas (L.) Schott: **11**. Allt an Toll-dhoire, 1988, G. Rothero, det. A. C. Jermy.

CONIFERS AND FLOWERING PLANTS

Pinus sylvestris L.: **14**. Hillside between Pennygown and Garmony.

Juniperus communis L. subsp. *alpina* (Neilr.) Celak. (subsp. *nana* Syme): **14**. On wall of ruined chapel, Pennygown, 1981, JWC. **17**. Shore south of Grass Point, 1984, AMcGS.

Trollius europaeus L.: **17**. Beside burn, Leckruah, 1983, JWC.

Ranunculus sceleratus L.: **1**. Bac Mor, 1987, L. Farrell. **6**. Near shore, Dervaig, 1987, B. Rae. **7**. Muddy shore below irises, Lagganulva, 1988, JWC.

Thalictrum alpinum L.: **10**. Beinn na Croise, 1983, R. W. M. Corner.

Papaver somniferum L.: **5**. Schoolhouse, Kilninian, 1983, JWC. **13**. Rubha nan Gall, 1982, A. Wright. In both instances plants appeared after cultivation of former garden ground.

Meconopsis cambrica (L.) Vig.: Spreading from mainland, now widely naturalized. **3**. Bunessan,

1981, JWC. **4**. Near farm buildings, Ulva, 1982, JWC. **10**. Shore, Pennyghael, 1981, JWC. **17**. Garden, Torosay Castle, 1981, JWC.
Dicentra formosa (Haw.) Walp. **: **17**. Naturalized in a wood at Craignure, 1981, JWC, **BM**.
Corydalis claviculata (L.) DC.: **4**. Growing over broom and bracken by shore, Ulva, 1982, JWC, **E**.
Fumaria bastardii Boreau: **3**. Arable field, Ardalanish, 1981, JWC, **BM** and **E**.
F. muralis Sonder ex Koch subsp. *boraei* (Jordan) Pugsley: **3**. Garden weed, Erraid, 1988, JWC, det. M. Lidén, **E**.
Fumaria officinalis L.: **4**: Arable field, Ulva, 1982, JWC, **BM**.
Brassica napus L.: **7**: Waste ground, Lagganulva, 1982, JWC.
B. rapa L.: **3**. Waste ground, Ardalanish, 1981, JWC, **BM**. **4**. Old garden, Gometra House, 1988, JWC. **9**. Knockan, 1981, JWC, **BM**.
Sinapsis arvensis L.: **3**. Knockvologan, 1977, A. Kelham. **7**. Lagganulva, 1982, JWC. **14**. Corrynachenchy, 1981, JWC.
Lepidium heterophyllum Benth.: **17**. Shore, Java, 1984, AMcGS.
Coronopus squamatus (Forskål) Aschers.: **2**. In gravel, Baile Mor, Iona, 1987, JWC, **E**. Confirms previous records.
Thlaspi arvense L. **: **6**. Garden path, Croig, 1986, A. A. Slack. **13**. Garden, Rubha nan Gall, 1984, A. Wright, **E**. Confirmation of 1967 record for this square.
Capsella bursa-pastoris (L.) Medicus: **15**. Garden, Scallastle, 1983, JWC.
Cochlearia officinalis L. subsp. *officinalis*: **11**. Shingle shore, Knock, 1987, JWC.
C. danica L.: **3**. Shore, Erraid, 1988, JWC.
Cardamine hirsuta L.: **10**: Waste ground, Pennyghael, 1981, JWC.
Barbarea vulgaris R. Br. **: **12**. Verge of A849, Glenforsa, 1981, JWC, **E**. **14**. Verge of A849, near Pennygown chapel, 1981, JWC, **E**.
Hesperis matronalis L.: **2**. Field margin near church, Iona, 1979, JWC.
Sisymbrium officinale (L.) Scop.: **3**. Waste ground near garden, Erraid, 1988, JWC & A. Walker. **7**. Abundant in arable fields, Lagganulva, 1982, JWC, **E**.
Arabidopsis thaliana (DC.) Heynh.: **3**. Sand-topped rocks, Fidden, and at Knockvologan, 1981, JWC, **E**. **6**. Nursery garden, Glengorm Castle, 1987, JWC. **8**. Allt na Teangaidh, 1981, A. Kelham. **9**. Eas Dubh, 1982, A. Kelham. **14**. Car park, Pennygown, 1981, JWC. **17**. Waste ground near car-park, Duart, 1986, JWC.
Polygala vulgaris L.: **11**. North-western shore of Loch Ba, 1988, G. Rothero. Field record.
Hypericum maculatum Cranz subsp. *maculatum*. **: **12**. Verge of A84, Glenforsa, 1984, AMcGS & JWC, det. N. K. B. Robson, **BM** and **E**. Previous record (1889) was from Aros Castle.
H. humifusum L.: **11**. Doire Darach, 1988, L. Farrell & R. Scott.
Silene latifolia Poiret subsp. *alba* (Miller) Greuter & Burdet (*S. alba* (Miller) E. H. L. Krause): **2**. Bishop's House garden and nearby waste ground, Iona, 1987, JWC. Considered in Jermy & Crabbe (1978, pp. 11, 13) as possible error for *S. dioica* (L.) Clairv.; now confirmed.
Stellaria graminea L.: **10**. On grassy waste ground, Pennyghael, 1984, JWC, **E**.
Arenaria leptocladus (Reichb.) Guss. *: **3**. On loose sand, Knockvologan, 1981, JWC, det. M. McCallum Webster, **E**.
Spergularia rubra (L.) J. & C. Presl: **9**. Forestry road near Shiaba, 1988, I. C. Christie. This species although listed by G. Ross, 1877, was considered an error by J. Cannon *et al.* This record now confirms this species for the island and it is possible that Ross was correct.
Spergularia marina (L.) Griseb.: **1**. On small rock outcrop, Bac Mór, 1987, L. Farrell.
Montia fontana L. subsp. *fontana*: **4**. Damp hollow in field, Ulva, 1982, JWC.
M. perfoliata (Willd.) Howell *: **13**. Garden, Rubha nan Gall, 1984, A. Wright, **E**. Probably brought in with mainland garden plants and now well-established.
M. sibirica (L.) Howell: **17**. Naturalized near houses, Java and Torosay, 1981, JWC.
Chenopodium album L.: **17**. Shore, Port nan Crullach, 1983, JWC, **E**.
Beta vulgaris L. subsp. *maritima* (L.) Arcangeli: **1**. Staffa, 1986, P. Wormell, **E**.
Atriplex glabriuscula Edmondston: **11**. Shingle shore, Knock, 1987, E. Stephenson, det. J. M. Mullin, **BM**.
Malva sylvestris L. **: **2**. By jetty, Iona, 1981, JWC, **E**. **3**. Ardtun, 1977, A. Kelham, **BM**. Confirms unlocalized 1939 record.
Aesculus hippocastanum L.: **9**. West of Carsaig, 1977, A. Kelham.

Buxus sempervirens L. *: **14**. Naturalized under brambles by field dyke, Garmony, 1981, JWC. Probably originated as seedling from old hedge in farm garden.
Cytisus scoparius (L.) Link subsp. *scoparius* (*Sarothamnus scoparius* (L.) Wimm. ex Koch). **4**. Near ferry, Ulva, 1982, JWC. **9**. On verge of A849 east of Bunessan, 1977, A. Kelham. **17**. On verge of A849 at Duart signpost, and also at Duart, 1981, JWC.
Trifolium campestre Schreber: **12**. Quarry track southwest of Salen, 1978, R. Coomber.
T. dubium Sibth.: **15**. On verge of A849, Alterich, 1983, JWC.
Vicia orobus DC.: **4**. Two sites on south coast of Ulva between Ulva House and Ormaig, 1980, A. Kelham. **8**. On cliffs, Dùn Bhuirg, 1988, P. Wormell. According to Bangerter & Cannon (1978) the record needed confirmation.
V. sylvatica L.: **16**, Loch Buie, 1956, H. Milne-Redhead; field card record omitted from Bangerter & Cannon (1978).
V. sepium L.: **14**. Corrynachenchy, 1981, JWC.
V. angustifolia L.*: **3**. Sandy shore, Ardalanish, 1981, JWC, **BM** and **E**.
Rubus spectabilis Pursh: **7**. Near farm, Lagganulva, 1982, K. Leitch. **12**. In hedge near Kellan farmhouse, 1981, A. Kelham, det. A. Newton.
R. plicatus Weihe & Nees: **15**. Roadside, Torness, 1984, AMcGS.
R. lindleianus Lees **: **2**. Iona, 1987, JWC. **4**. Ulva, 1982, JWC, **E**. **7**. Southeast of Kilbrennan, 1982, JWC, **E**. **17**. Craignure, 1984, AMcGS.
R. dumnoniensis Bab.: **4**. Ulva, 1982, JWC, **E**. **5**. Calgary, 1984, AMcGS. **7**. Achnacraig, 1984, AMcGS. **8**. Balevulin, 1984, AMcGS. **9**. Knockan, 1984, AMcGS. **10**. Dererach, 1981, JWC; **11**. Knock, 1984, AMcGS. **12**. Salen, 1981, JWC, **E**. **13**. Gualann Dhubh, 1984, AMcGS. **15**. Torness, 1984, AMcGS.
R. nemoralis P. J. Mueller (*R. selmeri* Lindeb.): **3**. Riverbank, Bunessan, 1981, JWC, **E**. **5**. Calgary, 1984, AMcGS. **6**. Dervaig, 1984, AMcGS. **8**. Dhiseig and Balevulin, 1984, AMcGS. **9**. Knockan, 1981, JWC. **11**. Knock, 1984, AMcGS. **13**. Aros Park, 1984, AMcGS. **14**. Fishnish, 1981, JWC.
R. polyanthemus Lindeb.: **4**. Ulva, 1982, JWC, **E**. **5**. Calgary, 1982, JWC, **E**. **7**. Rubha Mór, Loch na Keal, 1981, JWC, **E**. **8**. Balevulin, 1984, AMcGS. **9**. Knockan, 1984, AMcGS. **10**. Near Rossal, 1984, JWC. **11**. Loch na Keal, 1981, JWC, **E**. **13**. Gualann Dhubh, 1984, AMcGS. **14**. Fishnish, 1982, JWC, **E**. **15**. Torness, 1984, AMcGS. **16**. Croggan, 1983, JWC. **17**. Craignure, 1984, AMcGS.
R. septentrionalis W. R. C. Wats.: **2**. Drainage ditch, Iona, 1987, JWC, **E**. **5**. Calgary, 1984, AMcGS. **6**. Dervaig, 1984, AMcGS. **10**. Killiemore, 1984, AMcGS. **11**. Knock, 1984, AMcGS. **12**. Gruline, 1984, AMcGS. **13**. Gualann Dhubh, 1984, AMcGS. **17**. South of Grass Point, 1984, AMcGS.
R. subinermoides Druce*: **4**. Garden, Ulva House, 1982, JWC, **E**. **7**. Near shore, Lagganulva, 1988, JWC, **E**.
R. mucronulatus Borr.**: **4**. Ulva, 1982, JWC, **E**. Gometra, 1988, JWC. **7**. Achnacraig, 1984, AMcGS, **E**. **12**. Gruline, 1984, AMcGS. **17**. Port na Tairbeirt, 1984, AMcGS.
R. radula Weihe ex Boenne. **: **9**. Calgary, 1982, JWC, **E**. **8**. Port Uamha Beathaig, 1984, AMcGS, **E**. **13**. Aros Park, 1984, AMcGS, **E**.
R. rufescens Muell & Lefèv. *: **13**. Aros Park, 1984, AMcGS. **E**.
R. latifolius Bab. *: **4**. Old garden, Gometra House, 1988, JWC. **6**. Roadside, Croig, 1986, JWC. **8**. Port Uamha Beathaig, 1984, AMcGS. **12**. Roadside near Aros Castle, 1982, JWC, **E**.
Potentilla sterilis (L.) Garcke: **13**. Aros Park, 1986, JWC.
Geum urbanum L.: **17**. Woodland, Auchnacraig, 1988, A. Walker & E. Stewart.
Alchemilla alpina L.: **3**. Southwest of Ardalanish, 1977, A. Kelham. Unconfirmed field record.
Rosa rubiginosa L.: **11**. Sandy delta on northwestern shore of Loch Ba, 1988, G. Rothero, field record.
Prunus spinosa L.: **14** Garmony, 1981, JWC.
P. avium (L.) L.: **4**. Ulva, 1982, JWC. **5**. Treshnish House woods, 1983, JWC. **6**. Dervaig, 1983, JWC. **7**. Lagganulva, 1986, H. Leitch. **14**. Garmony, 1981, JWC. **16**. Croggan, 1983, JWC.
P. padus L.: **5**. Calgary and Tostarie, 1984, M. Barron. **8** Glen Seilisdeir, 1984, M. Barron. **11**. Scarisdale, 1984, M. Barron. **14**. Pennygown, 1984, M. Barron.
Cotoneaster microphyllus Wall. ex Lindl.: **2**: Cliff behind manse, Iona, 1979, JWC. **4**. Widespread over an acre of hill behind Gometra House, 1982, J. M. Howard. **17**. On rocks, Java Point, 1981, JWC.

Sorbus intermedia (Ehrh.) Pers.: **4**. On cliffs, Gometra, 1988, A. Walker, det. AMcGS.
S. croceocarpa P. D. Sell: **10**. Pennyghael, 1971, A. G. Kenneth (recorded as *S. latifolia* in Bangerter & Cannon 1978).
S. rupicola (Syme) Hedl. **17**. Port na Tairbeirt, 1984, AMcGS. Additional site record.
Sedum spurium Bieb. *: **7**. In roadside rock crevice, Lagganulva, 1986, H. Leitch, **E**. Presumably escape from distant garden.
S. acre L.: **11**. Shore, Knock, 1987, JWC.
Saxifraga stellaris L.: **10**. Beinn na Croise, 1980, A. Kelham.
S. × *urbium* D. A. Webb: **12**. Glenforsa Lodge woods, 1981, JWC, **BM**.
Saxifraga hirsuta L. **: **3**. Roadside near car-park, Aros Park, 1986, JWC, **E**, (det. C. A. Stace).
S. tridactylites L. **: **2**. Rocks above Sandeels Bay, Iona, 1981, JWC, **E**. **3**. Fidden rocks, 1981, JWC, **E**.
S. aizoides L.: **11**. Scarisdale river, 1983, R. W. M. Corner; Allt na Coille Móire, 1988, L. Farrell & R. Scott.
S. oppositifolia L.: **11**. Maol na Damh, 1988, A. & J. Gardner.
Chrysosplenium oppositifolium L.: **1**: Lunga, 1983, R. Coomber.
Ribes rubrum L.: **13**. Growing in garden wall, Rubha nan Gall, 1986, A. Wright.
R. nigrum L.: **5**. Reudle, 1983, JWC. **6**. Druimghigha, 1986, M. North. **8**. Balevulin, 1984, JWC.
Lythrum salicaria L.: **17**. Port na Tairbeirt, 1984, AMcGS.
Epilobium hirsutum L. *: **13**. Waste ground, Tobermory, 1978, R. Coomber, **E**.
E. parviflorum Schreber: **11**. Forestry plantation, Maol na Coille Móire, 1988, L. Farrell & R. Scott.
E. ciliatum Rafin. *: **4**. Ulva House garden, 1982, JWC, **E**.
E. obscurum Schreber: **5**. Haunn, 1983, B. Rae. **11**. Forestry plantation, Maol na Coille Móire, 1988, L. Farrell & R. Scott.
Chamerion angustifolium (L.) J. Holub (*Epilobium angustifolium* L.): **11**. Loch Ba, 1988, A. Walker & E. Stewart; Forestry plantation, Maol na Coille Móie, 1988, L. Farrell & Scott.
Fuchsia magellanica Lam.: **4**. Naturalized, Ulva, 1982, JWC. **8**. Tiroran, 1984, AMcGS.
Circaea lutetiana L.: **11**. Wooded ravine, Allt an Toll-dhoire, 1988, G. Rothero.
Callitriche stagnalis Scop.: **1**. Staffa, 1986, P. Wormell. **14**. Garmony, 1981, JWC.
C. hamulata Koch (*C. intermedia* subsp. *hamulata* Koch): **2**. Pool on top of Dun I, Iona, 1979, JWC, **BM**, **E**.
Eryngium maritimum L.: **1**. Lunga, 1983, B. Rae. **2**. At time of British Museum Survey not seen on Iona, but refound at the north end of the island in 1979 by H. Rhodes.
Anthriscus sylvestris (L.) Hoffm.: **3** Cùl a'Bhaile, 1984, A. Kelham.
Conium maculatum L.: **12**. Arla farm, 1978, R. Coomber.
Heracleum sphondylium L.: **14**. Widespread, 1981, JWC.
H. sphondylium L. *var. angustifolium* Huds. *: **2**. Jetty, Iona, 1987, JWC, **E**.
Euphorbia dulcis L. *: **12**. Glenforsa Lodge woods, widely naturalized, 1981, JWC, **E**.
Polygonum aviculare L. sensu lato: **11**. Shore, Knock, 1987, JWC.
P. bistorta L. **: **4**. Ulva, 1988, JWC. Well established on waste ground beside farm road. Probable escape from Ulva House garden.
Polygonum amphibium L.: **4**. Shore, Ulva, 1982, JWC. **17**. Rubha na Sroine, 1981, JWC.
P. hydropiper L.: **8.** Ardmeanach, 1984, AMcGS. **16**. Leckruah, 1983, JWC.
Polygonum campanulatum Hooker fil.: **8**. Tiroran, 1984, AMcGS.
Reynoutria sachalinensis (F. Schmidt Petrop.) Nakai (*Polygonum sachalinense* F. Schmidt Petrop.): **12**. Verge of B8073 at head of Loch na Keal, and at Aros, 1987, JWC. **17**. Torosay Castle woods by railway, 1987, JWC.
R. japonica Houtt. (*Polygonum cuspidatum* Sieb. & Zucc.): **4**. Near church, Ulva, and roadside, Gometra, 1988, JWC.
Rumex longifolius DC. *: **10**. Roadside, Glen Leidle, 1984, AMcGS, **E**. A new vice-county record.
R. obtusifolius L.: **14**. Widespread, 1981, JWC.
R. sanguineus L. var. *viridus* Sibth.: **7**. Lagganulva, 1982, JWC, **E**.
Parietaria judaica L. (*P. diffusa* Mert. & Koch) *: **17**. Wall, Duart Castle, 1983, R. W. M. Corner, **E**.
Soleirolia soleirolii (Req.) Dandy *: **4**. In cracks in steps and round base of Gometra House, 1988, M. Jones, **E**. Introduced.

Humulus lupulus L. *: **6**. Ruins of clachan in Glengorm afforested area, 1962, A. Wright (photo, **BM**).
Ulmus glabra Huds.: **9**. Near Scoor, 1978, A. Kelham.
Ficus carica L. *: **13**. Rock cleft near gun emplacement, Tobermory, 1983, A. Wright.
Alnus incana (L.) Moench: **7**. Moribund plantation, Loch Frisa, Salen Forest, 1979, A. Kelham.
Populus tremula L.: **17**. Cliffs south of Grass Point, 1984, AMcGS.
P. nigra agg. **: **8**. Clachandhu, 1982, A. Kelham. **14**. Garmony, 1981, JWC, **BM**.
Salix alba L.: **8**. Kilfinichen, 1984, AMcGS, **E**.
S. herbacea L.: **5**. Carn Mór, 1983, R. W. M. Corner. **7**. Speinne Mór, 1983, R. W. M. Corner. **10**. Beinn na Croise and An Sgulan, 1983, R. W. M. Corner.
Rhododendron ponticum L.: **4**. Ulva, 1982, JWC.
Arctostaphyllos uva-ursi (L.) Spreng.: **10**. Island in Loch Fuaron, 1977, A. Kelham.
Orthilia secunda (L.) House **: **13**. Near Sput Dubh, 1981, D. Kelly.
Empetrum hermaphroditum Hagerup: **11**: Beinn a'Ghràig, 1983, R. W. M. Corner.
Trientalis europaea L. *: **16**. Above birch wood in flattish area of bracken and heather, A'Bhuigneach, 1987, A. Gardner. **17**. Flat ground with *Sphagnum* and young birch trees, Java Point, 1981, JWC, **BM** and **E**.
Anagallis tenella (L.) L.: **17**. Port Donain, 1978, R. Coomber.
A. arvensis L.: **4**. Gometra, 1982, J. E. Howard; arable field, Ulva, 1982, M. Cowe, **E**.
Gentianella campestris (L.) Börner: **1**. Staffa, 1986, P. Wormell.
Symphytum officinale L.: **3**. Waste ground near coastguard cottages, Erraid, 1988, JWC & A. Walker. **4**. Naturalized, old garden, Ulva, 1982, JWC, **E**.
S. × *uplandicum* Nyman: **3**. Waste ground behind croft house, Erraid, 1988, JWC & A. Walker.
S. tuberosum L. **: **14**. Near jetty, Fishnish, 1981, JWC, **E**.
Borago officinalis L. *: **2**. Waste ground and gardens in Baile Mór, Iona, 1987, JWC. Introduced for bees, and now spreading widely.
Pentaglottis sempervirens (L.) Tausch: **6**. Garden escape, Glengorm Castle, 1987, JWC. **17**. Naturalized outside garden of Duart Castle, 1981, JWC.
Mertensia maritima (L.) Gray: **4**. Little Colonsay, 1982, J. M. Howard. **5**. Only one small plant seen at Calgary, but colony at Ensay Burn luxuriant and spreading. **12**. North shore of head of Loch na Keal, 1986, R. Coomber. **11**. Extensive stretch on spit at head of Loch na Keal, north of fish hatchery, 1988, JWC.
Calystegia sepium (L.) R.Br.: **2**. Baile Mór, Iona, 1987, JWC. **4**. Farm road, Ulva, 1982, JWC, **E**. On shore, Gometra, 1988, M. North. **17**. Waste ground, Java, 1987, JWC.
C. pulchra Brummitt & Heywood: **7**. Lagganulva, 1982, H. Leitch.
Solanum dulcamara L. **: **17**. Shore, Port Donain, 1978, R. Coomber.
Scrophularia nodosa L.: **17**. Port na Tairbeirt, 1984, AMcGS.
Mimulus moschatus Douglas ex Lindley: **17**. Waste ground, Java, 1984, AMcGS.
Sibthorpia europaea L. *: **11**. Beside track between Mausoleum and Gruline House, 1988, A. Walker & E. Stewart, **GL**. Probably introduced.
Veronica scutellata L.: **3**. In flush, Erraid, 1988, A. Walker.
V. montana L.: **17**. Wood edge, Port Donain, 1978, R. Coomber.
V. agrestis L.: **3**. Island House, Dunan Mór, 1977, A. Kelham.
V. filiformis Sm.: **3**. Lawn, Bunessan, 1981, JWC, **E**. **15**. Lawn, Scallastle, 1983, JWC.
Rhinanthus minor L.: **1**. Bac Mór, 1987, L. Farrell.
R. borealis (Sterneck) P. D. Sell: **11**. Scarisdale river, 1983, R. W. M. Corner.
Odontites verna (Bellardi) Dumort.: **1**. Lunga, 1983, B. Rae. **11**. Shore, Knock, 1987, JWC.
Orobanche alba Willd.: **8**. South Ardmeanach, near shore, 1976, P. Wormell.
Mentha arvensis L.: **7**. Field edge, Torloisk, 1982, JWC, **E**.
Mentha × *piperita* L. *: **12**. Marsh by shore, Salen, 1983, R. W. M. Corner, det. R. M. Harley.
M. suaveolens Ehrh. *: **13**. Naturalised, Rubha nan Gall, 1984, A. Wright, det. R. M. Harley.
M. × *villosa* Huds. nm. *alopecuroides* (Hull) Briq. *: **2**. Martyrs' Bay, Iona, 1981, JWC, det. R. M. Harley, **E**. **12**. Roadside verge, Salen, 1983, R. W. M. Corner, det. R. M. Harley. **17**. Grass Point and Java, 1984, AMcGS.
Lycopus europaeus L.: **14**. By jetty, Fishnish, 1981, JWC.
Stachys palustris L.: **11**. Field verge, Knock, 1987, JWC.

S. × *ambigua* Sm.: **17**. By shore, Java, 1984, AMcGS, **E**.
Lamium amplexicaule L.: **6**. Garden, Druimghigha, 1986, M. North.
L. hybridum Vill. **: **3**. Garden, coastguard cottages, Erraid, 1988, JWC & A. Walker, **E**.
L. album L.: **6**. Glen Gorm Nursery Garden, 1984, B. Rae.
Scutellaria galericulata L.: **15**. Shore, Alterich, 1983, JWC.
Campanula latifolia L.: **4**. Garden escape, roadside, Ulva, 1982, JWC.
Sherardia arvensis L.: **9**. Near Scoor, 1981, M. Collier, **E**.
Galium album Miller: **12**. On verge of A849, Pennygown, 1984, AMcGS, **E**.
G. uliginosum L.: **11**. By burn, Airigh Lag nan Cluas, 1988, L. Farrell & R. Scott.
Sambucus nigra L.: **14**: Corrynachenchy, 1981, JWC.
Symphoricarpos albus (L.) S. F. Blake var. *laevigatus* (Fernald) S. F. Blake (*S. rivularis* Suksd.): **8**. Beside B8035, Balevulin, 1984, JWC. **14**. Corrynachenchy, 1981, JWC.
Valerianella locusta (L.) Laterrade: **16**. Loch Buie, 1979. R. Coomber.
Dipsacus fullonum L. *: **6**. Casual on waste ground, Croig, 1983, B. Rae.
Senecio sylvaticus L.: **12**. Quarry track south-west of Salen, 1979, R. Coomber. **17**. Pier, Craignure, 1985, C. Murray.
S. viscosus L.: **6**. Waste ground, Dervaig, 1983, B. Rae.
S. vulgaris L.: **14**. Pennygown, 1981, JWC. **15**. Garden, Alterich, 1983, JWC.
Tussilago farfara L.: **11**. Forestry plantation, Maol na Coille Móire, 1988, L. Farrell & R. Scott. **14**. Pennygown, 1981, JWC.
Inula helenium L.: **5**. Roadside near school, Kilninian, 1983, JWC.
Eupatorium cannabinum L.: **17**. South of Grass Point, 1984, AMcGS.
Tripleurospermum maritimum (L.) Koch: **11**. Shore, Knock, 1988, JWC. **15**. Scallastle, 1983, JWC.
Matricaria matricarioides (Less.) Porter: **15**. Alterich, 1983, JWC.
Tanacetum parthenium (L.) Schultz Bip.: **15**. Alterich, 1983, JWC. **17**. Waste ground, Java, 1983, JWC.
T. vulgare L.: **17**. Beside old house, Grass Point, 1984, JWC.
Arctium minus Bernh. subsp. *nemorosum* (Lej.) Syme.: **14**. Forestry roadside, Fishnish, 1981, JWC.
Cirsium helenioides (L.) Hill (*C. heterophyllum* (L.) Hill) **17**. Verge of A849, Torosay, 1984, AMcGS.
Leontodon taraxacoides (Vill.) Mérat: **13**. Car-park, Aros Park, 1984, AMcGS.
Sonchus arvensis L.: **8**. Shore, Balmeanach, 1984, JWC. 11. Shore near Knock, 1987, JWC.
S. asper (L.) Hill: **11**. Forestry plantation, Maol na Coille Móire, 1988, L. Farrell & R. Scott.
Hieracium rubiginosum F. J. Hanb.: **11**. Beinn Fhada, 1967, A. Kenneth, **CGE**. Omitted from Flora of Mull (Bangerter & Cannon 1978).
H. pilosella L. (*Pilosella officinarum* C. H. & F. W. Schultz subsp. *officinarum*): **17**. Shore, Grass Point, 1984, AMcGS.
Crepis capillaris (L.) Wallr.: **11**. Shore near Knock, 1987, JWC. **14**. A849 verge, Garmony, 1981, JWC.
Taraxacum duplidentifrons Dt. (= *T. raunkiaerii* Wiinst): **2**. Dunes and machair, Iona, 1989, JWC. **3**. Sea wall, Bunessan, 1981, JWC, **E**. **17**. Java Point and Craignure, 1981, JWC.
Taraxacum euryphyllum (Dahlst.) M. P. Christensen: **3**. Uisken, 1981, JWC, **E**.
T. landmarkii Dahlst.: **17**. Java Point, 1981, JWC, **E**.
T. maculosum A. J. Richards (*T. maculigerum* H. Lindb. f.): **3**. Machair, Fidden, 1981, JWC, **E**. **14**. Fishnish, 1981, JWC, **E**.
T. spectabile Dahlst.: **10**. Pennyghael, 1981, JWC, **E**.
T. unguilobum Dahlst.: **14**. Fishnish, 1981, JWC, **E**.
T. stictophyllum Dahlst. *: **17**. Torosay Castle grounds, 1981, JWC, **E**.
Triglochin maritima L.: **15**. Shore, Alterich, 1983, JWC.
Polygonatum multiflorum (L.) All.: **4**. Garden escape, Ulva, 1982, M. Cowe.
Scilla verna Huds.: **3**. Fidden, 1972, C. Murray. **9**. Garbh Eilean, 1981, J. Edwards.
Juncus squarrosus L.: **4**. Moor, Ulva, 1982, JWC.
J. triglumis L.: **11**. Maol Meadhonach, 1988, A. Gardner.
Allium ursinum L.: **14**. Doire Dorch, 1981, JWC.
Leucojum vernum L. *: **13**. Naturalized in glen, Tobermory, 1979, R. Coomber, **E**.

Cephalanthera longifolia (L.) Fritsch: **13**. Loch a'Churrabain, 1979, R. Coomber.
Listera ovata (L.) R.Br.: **3**. Dunes, Traigh Gheal, Erraid, 1988, A. Walker. **17**. Meadow, Auchnacraig, 1988, A. Walker & E. Stewart.
Neottia nidus-avis (L.) Rich.: **10**. Under lime trees above Carsaig Bay, 1985, A. Gardner. **17**. Hazel/ash wood, Druim Mór Aird na Drochaide, 1987, E. Campbell & A. Walker.
Pseudorchis albida (L.) Á. & D. Löve: **3**. Ben Talaidh, 1977, A. Kelham. **9**. Knockan, 1981, JWC. **16**. Ardura, Loch Spelve, 1988, A. & J. Gardner. Previous record 1848. **17**. Abundant on hill slope, Gorten, 1981, JWC, **E**.
Platanthera chlorantha (Custer) Reichenb.: **6**. Grassy slope, Croig, 1983, B. Rae.
Orchis mascula L.: **13**. Riverbank, Tobermory, 1976, R. Coomber.
Dactylorhiza fuchsii (Druce) Sóo: **17**. Meadow, Auchnacraig, 1988, A. Walker & E. Stewart.
D. incarnata (L.) Soó subsp. *incarnata*: **7**. Meadow, Oskamull, 1983, H. Leitch.
D. incarnata (L.) Soó subsp. *pulchella* (Druce) H. Harrison fil. *: **17**. Port na Tairbeirt, 1984, AMcGS, **E**.
D. incarnata (L.) Soó subsp. *coccinea* (Pugsl.) H. Harrison fil. *: **5**. Machair, Port Langamull, 1984, R. Coomber.
Lysichiton americanus Hulten & St. John *: **14**. Shore among irises at burn outflow, Fishnish, 1988, B. Rae & R. Douglas.
Arum maculatum L. **: **13**. One plant on shore near pier, and colony of many hundreds on wooded slope below Courthouse beside Prison Brae, 1986, A. Wright, **E**.
Scirpus maritimus L.: **9**: Brackish pool, Port nan Droigheann, 1988, J. Muscott & J. Winham.
S. tabernaemontani C. C. Gmel: **9**. Freshwater marsh, Port nan Droigheann, 1988, J. Muscott & J. Winham.
Eleocharis uniglumis (Link) Schultes: **11**. Airigh Lag nan Cluas, 1988, L. Farrell & R. Scott.
Blymus rufus (Huds.) Link: **9**. Shore, Knockan, 1981, JWC.
Rhynchospora alba (L.) Vahl: **6**. Druimghigha, 1986, M. North.
Carex lepidocarpa Tausch *: **4**. Near shore, Ulva, 1982, **BM** and **E**. **11**. Grassy sand/shingle delta, northwest shore Loch Ba, 1988, G. Rothero. Field record.
C. viridula Michx subsp. *viridula* (*C. serotina* Mérat): **17**. Shore, Craignure, 1984 AMcGS, **E**.
C. extensa Gooden.: **3**. Shore, Erraid, 1988, JWC & A. Walker. **8**. Balmeanach, 1984, AMcGS.
C. sylvatica Huds.: **9**. Cliff scrub, Port nan Droigheann, 1988, J. Muscott & J. Winham. **11**. Wood, Glen Clachaig, 1988, A. Walker & E. Stewart. **17**. Woodland, Auchnacraig, 1988, A. Walker & E. Stewart.
C. vesicaria L.: **6**. Silted-up dam, Quinish gardens, 1986, M. North.
C. bigelowii Torr. ex Schwein: **10**. Beinn na Croise, 1983, R. W. M. Corner.
Carex paniculata L.: **7**. East side of Carn Mór, 1986, M. North. **9**. Freshwater marsh, Port nan Droigheann, 1988, J. Muscott & J. Winham.
C. remota L.: **17**. Druim Mór Aird na Drochaide, 1987, A. Walker.
C. curta Gooden: **10**. Beinn na Croise, 1985, A. Kelham.
Glyceria declinata Bréb.: **8**. Balmeanach, 1984, AMcGS.
Festuca arundinacea Schreber: **5**. Calgary, 1984, AMcGS.
F. tenuifolia Sibth.: **7**. Gravel bank, Fanmore, 1982, JWC; **E**.
Puccinellia distans (L.) Parl.: **17**. Shore, Java, 1984, AMcGS.
Poa angustifolia L. **: **1**. Found in dense grassland on Staffa, 1969, British Museum Survey, **BM**. Omitted in error from Cannon & Bangerter (1978).
P. subcaerulea Sm.: **4**. Shore track, Ulva, 1988, A. Walker.
P. chaixii Vill. *: **17**. Naturalized on pond edge, Torosay gardens, 1987, JWC, **E**.
Catabrosa aquatica (L.) Beauv. subsp. *minor* (Bab.) Perring & Sell: **7**. Shore, Lagganulva, 1988, JWC.
Bromus ramosus L.: **17**. Woodland, Auchnacraig, 1988, A. Walker & E. Stewart.
B. hordeaceus L. subsp. *hordeaceus*: **15**. Waste ground, Scallastle, 1983, JWC.
Elymus caninus (L.) L. (*Agropyron caninum* (L.) Beauv.): **7**. Ash wood, Acharonach, 1988, A. Walker & E. Stewart.
Deschampsia cespitosa (L.) Beauv., viviparous variant *: **11**. Scarisdale river bank, 1983, R. W. M. Corner.

Aira caryophyllea L. subsp. *multiculmis* (Dumort.) Aschers. & Graebn. ex Hegi *: **5**. Roadbank, Kilninian, 1982, JWC, **E**.
Calamagrostis epigejos (L.) Roth: **11**. Wet woodland northwest shore of Loch Ba, 1988, G. Rothero. One plant only.
Alopecurus pratensis L.: **4**. Roadside, Ulva, 1982, JWC.
Phalaris arundinacea L.: **14**. Corrynachenchy, 1981, JWC.

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REFERENCES

Bangerter, E. B. & Cannon, J. M. F. (1978). Flowering plants and conifers, in Jermy, A. C. & Crabbe, J. A., eds. *The Island of Mull: a survey of its flora and environment*. London.
Dandy, J. E. (1958). *List of British vascular plants*. London.
Jermy, A. C. & Crabbe, J. A., eds. (1978). *The Island of Mull: a survey of its flora and environment*. London.
Edees, E. S. & Newton, A. (1988). *Brambles of the British Isles*. London.

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Five brambles from Wales

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ABSTRACT

The history of the study of brambles in Wales is summarised and five new species are described: **Rubus tavensis** Newton & Porter, **sp. nov.**, **R. aquarum** Newton & Porter, **sp. nov.**, **R. gallofuscus** Newton & Porter, **sp. nov.**, **R. biloensis** Newton & Porter, **sp. nov.**, and **R. merlini** Newton & Porter, **sp. nov.**

INTRODUCTION

Valuable pioneering studies of the Welsh brambles were made in the last decade of the nineteenth century by J. W. Griffith in the Bangor district, A. Ley, who collected in many parts of Wales and the Marches and W. M. Rogers who visited the upper Wye Valley and adjacent areas in 1898. Riddelsdell (1907), assisted by Rogers and Ley, compiled a lengthy Glamorgan list and with W. C. Barton visited the Dolgellau and Portmadoc areas in 1922–23, making extensive collections of the local plants (now in **BM**). The results of these endeavours can be studied in most of the major British herbaria and provide a solid foundation for systematic enquiry.

Knowledge of the Welsh Rubus flora has steadily increased since the brief visit of Watson (1950). *A Welsh bramble foray* (Newton 1972) described the fruits of a tour through northern and central Wales. Specimens collected by T. A. W. Davis in Pembrokeshire and Carmarthenshire were annually examined by E. S. Edees and A. N. and further surveys of South Wales produced new taxa described by Newton (1974) and an account of the *Rubi* of Glamorgan and adjacent areas (Newton 1976). In 1978 a B.S.B.I. field meeting based at Lampeter added considerably to the records for Cardiganshire and northern Carmarthenshire, updating the account of *Rubus* in Salter (1935). Visits to North Wales were made sporadically and the accumulated wisdom of these excursions, together with Welsh records from **NMW** and other herbaria, were collated by A. N. in Ellis (1983), which included some distribution maps. Also incorporated were records from M.P. who had been investigating the *Rubi* of Breconshire and gathering information for a county Flora since 1970. A joint visit in 1983 allowed many of the problematic local species of Breconshire to be studied in situ. The B.S.B.I meeting based at Carmarthen reported by Pryce (1988) provided information from previously unrecorded areas, which was included in the monograph by Edees & Newton (1988). Gradually it has become possible to discern the extent of some recognised but hitherto unnamed taxa and to establish new distribution data for others. Even now not all Welsh brambles can be satisfactorily named, but few of these are other than single bushes or of limited local occurrence. The following descriptions are therefore the outcome of lengthy and painstaking study in the field and herbarium.

Rubus tavensis Newton & Porter, **sp. nov.** (Series *Rhamnifolii*)

Turio altiarcuatus in apricis purpureus pruinosus angulatus faciebus planis leviter pilosus aculeis ad angulos limitatis aequalibus validis patentibus rectis vel raro leviter curvatis e basi compressa

paulatim contractis armatus. Folia quinata pedata vel subdigitata pusilla inferne griseoviridia pilosa; foliolum terminale late obovatum vel suborbiculare apice cuspidatum basi integra margine aequaliter serrata longe petioluatum. Inflorescentia longa angustata inferne 2–4 foliis ternatis superne 1–2 foliis simplicibus ornata; ramuli medii ± patentes 2–5 flori alte divisi. Rachis vix flexuosa dense pilosa aculeis curvatis validis nonnullis armata. Flores 2·5 cm diam.; sepala reflexa tomentosa grisea; petala rosea obovata pubescentia; stamina stylos virides basi roseos vix superantia; anthera glabra vel sparsim pilosa; carpella pilosa; fructus parvus rotundus.

Stem arching, dull purple on exposed side, pruinose, angled with flat sides, very thinly hairy with few short simple or tufted hairs and more frequent stellate hairs, scattered sessile or subsessile glands, prickles (c. 10 per 5 cm) on the angles, equal, strong, about as long as the stem diameter, straight or rarely slightly curved, ± patent, dull purple with straw coloured tips. Leaves 5-nate, pedate or subdigitate, leaflets rather small, usually not contiguous, dull green and glabrous or sparsely strigose above, pale greyish-green and hairy beneath with numerous short or very short simple hairs, sparse to frequent stellate hairs and occasional inconspicuous sessile glands; terminal leaflet broadly obovate or suborbicular with entire or, rarely, emarginate base and shortly cuspidate tip; margin flat or slightly undulate, finely and evenly serrate, petiolule long (c. 45% length of lamina); intermediate leaflets only slightly smaller than the terminal; basal leaflets with petiolules 3–4 mm; petioles about the same length or longer than basal leaflets, coloured and clothed like the stem and with 12–15 small falcate prickles (2–3 mm). Flowering branch long and cylindrical, with 2–4 ternate leaves at the base subtending ascending peduncles usually shorter than the leaves, and 1–2 simple leaves, not leafy to the apex; peduncles of the ultra-axillary part almost patent, divided well above the middle and bearing 2–5 flowers. Rachis slightly flexuose, densely hairy with short, patent, simple or tufted whitish hairs, stellate hairs, some inconspicuous sessile or subsessile glands, strongly armed with stout curved prickles (4–7 mm); peduncles and pedicels clothed as rachis but with smaller curved prickles. Flowers about 2·5 cm in diameter; sepals reflexed, greyish felted, with simple hairs and dense stellate hairs; petals pink or pale pink, obovate, c. 13 × 8 mm, downy; stamens about the same length or rather longer than the styles, anthers glabrous or sparsely hairy, filaments pink or white; styles pale green or pink-based; young carpels hairy; receptacle glabrous; fruit round, small with few drupelets. Flowering in July and August.

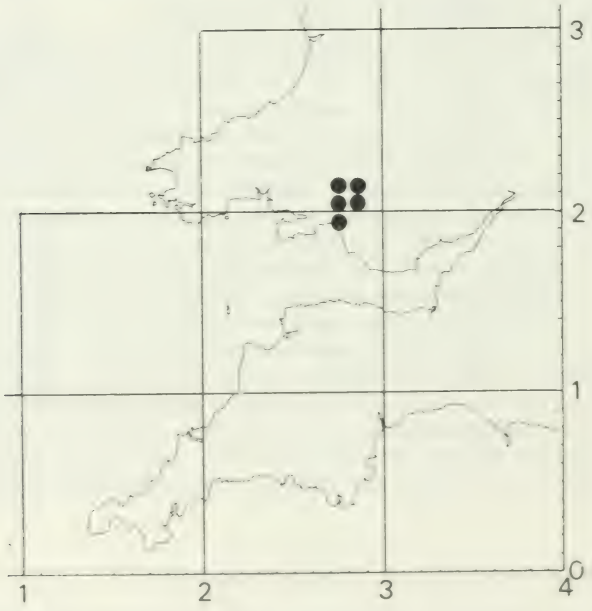

FIGURE 1. Distribution of *Rubus tavensis* Newton & Porter

HOLOTYPE: near Wern Plemys wood, Ystradgynlais, Brecs., v.c. 42, GR 22/790.095, 21 July 1988, *M. Porter* (**NMW**).

This bramble was named *Rubus godroni* Lec. & Lam. var. *foliolatus* by W. M. Rogers and A. Ley. Their very brief description in *J. Bot.* **44**: 58 (1906) forms the basis for the entry in the addendum of Edees & Newton (1988), but also covered originally the Cheshire bramble subsequently described as *Rubus robii* (W. C. R. Watson) Newton. Rogers and Ley noted that the plant was first observed at Aberpergwm in the Nedd valley about 1890. The earliest herbarium specimen we have traced is at **BIRM**, collected by A. Ley on 21 July 1899 from Ystalyfera in the Tawe valley.

The bramble is frequent in the south-west of Brecs. (v.c. 42) and adjacent parts of Glam. (v.c. 41) and is a particular feature of the valleys of the Tawe and Nedd. The long narrow leafy panicle and the small leaflets are distinctive features.

Representative exsiccata: Glam., v.c. 41, Neath, 25 July 1905, *H. J. Riddelsdell* (**NMW**). Brecs., v.c. 42, Ystalyfera, 21 July 1899, *A. Ley* (**BIRM**); Ystradgynlais, 25 July 1899, *A. Ley* (**LIV**); Penwyllt, 4 August 1899, *A. Ley* (**BIRM**); Cellwen, 2 August 1906, *A. Ley* (**BIRM**); Pen-y-Cae, 27 July 1977, *M.P.* (**herb. M.P.**); Cwm Twrch, 1 August 1977, *M.P.* (**herb. M.P.**); Abercraf, 17 August 1978, *M.P.* (**herb. M.P.**); Cwm Giedd, 27 July 1982, *M.P.* (**herb. M.P.**).

The known distribution is shown in Fig. 1.

Rubus aquarum Newton & Porter, **sp. nov.** (Series *Mucronati*)

Turio primo arcuatus tandem procumbens faciebus planis vel concavis in apricis erubescens vel fusco-purpureus angulatus fere glaber glandulis aciculisque sparsis brevibus, aculeis plerumque ad angulos limitatis rectis tenuibus e basi vix compressa et aculeolis brevioribus raris obsitus. Folia (3–)5nata pedata vel subdigitata inferne sparsim pilosa; foliolum terminale obovatum basi subcuneata apice cuspidatum margine denticulata. Inflorescentia diffusa inferne foliis ternatis (foliolo medio basi cuneata), superne uno folio ovato ornata apice aphylla ± pyramidata pedunculis pedicellisque longis; ramuli medii 1–4 flori. Rachis flexuosa aculeis tenuissimis falcatis declinatisve armata superne dense pilosa et tomentosa glandulis brevibus aciculisque nonnullis obsita. Flores (2–)2·5–3 cm, in umbrosis minores stellati, sepala reflexa griseoviridia tomentosa glandulifera aciculata; petala obovata roseo-lilacina ciliata; stamina stylos superantia, anthera pilosa; filamenta lilacina basi vinoso-purpurea. Carpella pilosa; fructus subglobosus.

Stem low-medium arching at first, then trailing or scrambling, angled with flat or slightly furrowed sides, reddish-brown or purplish-brown in exposure, obscurely striate, almost glabrous but with rare short simple or tufted hairs, locally frequent sessile glands and occasional short stalked glands and acicles; prickles (c. 10 per 5 cm) mostly on the angles, slender, declining from a slightly compressed base, coloured as the stem or with yellow tips, ± equal (c. 5–6 mm) but with an occasional shorter prickle. Leaves pedate or subdigitate; leaflets (3–)5, not contiguous, upper surface dark green, thinly strigose or almost glabrous, sometimes weakly plicate, lower surface sparsely clothed with short and very short simple hairs and sessile glands. Terminal leaflet c. 7 × 4 cm, obovate with sides tapering to a narrow rounded or cuneate base, apex cuspidate, margin flat or undulate with fine slightly irregular teeth; petiolule c. 30–40% length of lamina. Petiole as long or longer than the basal leaflets, coloured as the stem, with about 12–15 small falcate prickles and sparsely clothed with simple hairs and sessile glands, few short or very short stalked glands, rare acicles and some stellate hairs. Inflorescence diffuse and showy, with 2–4 ternate leaves having markedly cuneate central leaflets, subtending ascending peduncles as long as or shorter than the leaves, usually one broadly ovate simple leaf, not leafy to the apex; the upper part of the inflorescence more or less pyramidal with long peduncles and pedicels so that the flowers are well spaced, middle peduncles with 1–4 flowers. Rachis flexuose, with a few very slender falcate or declining prickles (to 4 mm), rather thickly clothed especially on the upper part with frequent short simple or tufted hairs and stalked glands mostly shorter than the hairs, a few acicles and dense grey felt; pedicels mostly 1–2 cm, clothed as upper rachis but with more stalked glands and acicles exceeding the short hairs and with a few straight, patent, very fine pricklets (up to three times the diameter of the pedicel). Flowers (2–)

2·5–3 cm diameter (smaller in shade), starry; sepals reflexed, greyish-green, closely felted and with short mainly adpressed simple hairs, few to many acicles and short stalked glands; petals c. 14 × 7 mm, obovate, narrowed to a short claw, lilac-pink, hairy and with ciliate margins; stamens longer than styles, anthers cream with lilac sutures, pilose; filaments lilac shading to bright reddish-purple at the base; styles biscuit or pale green; young carpels hairy; receptacle hairy; fruit subglobose of about 20–30 drupelets. Flowering in July and August.

HOLOTYPE: hedge west of Llanwrtyd Wells, Brecs., v.c. 42, GR 22/872.459, 18 July 1988, *M. Porter* (**NMW**).

A. Ley first collected this bramble from a wood at Llanwrtyd Wells in 1897. It was determined by W. O. Focke as *Rubus lejeunei* W. & N. and appears thus in Rogers (1900), although the author was unusually sceptical about Focke's naming in this case. Later, the same plant, which Ley had gathered from several places in northern Breconshire, was equated with *Rubus breconensis* W. C. R. Watson (Watson 1958). Subsequently both Edees and Newton noted that Ley's bramble did not match the type specimen of *R. breconensis* in **BM**. Although the taxa have some affinity, especially in floral characters, the northern Breconshire plant has almost glabrous stems with rare acicles and fewer prickles which are more or less equal and restricted to the angles. The inflorescence is more spectacular having larger well-spaced lilac flowers with conspicuous magenta filaments. Because it is such a distinctive plant and features prominently in the literature it was thought desirable to describe it, in spite of a limited distribution. As it has been found across northern Breconshire in a zone which includes the Victorian spas of Llanwrtyd, Llangammarch and Builth with their associated mineral springs we have named it *Rubus aquarum*.

Representative exsiccata: Brecs., v.c. 42, Llanwrtyd Wells, 14 July 1897, *A. Ley* (**BIRM**, **NMW**); Builth Wells, 9 August 1898, *A. Ley* (**BIRM**); Llangammarch Wells, 25 July 1907. *A. Ley* (**BIRM, NMW**); Gorwydd, 26 July 1907, *A. Ley* (**BIRM**); Llangammarch Wells, 1 August 1963, *E. S. Edees* (**NMW**), Glannau Wells, Builth, 9 August 1980, *M.P.* (**herb. M.P.**); Cwm Dyfnant, 21 August 1982, *M.P.* (**herb. M.P.**).

The known distribution is shown in Fig. 2. A record for Rads., v.c. 43, from Llandrindod Wells, fide Watson (1958), has not been confirmed.

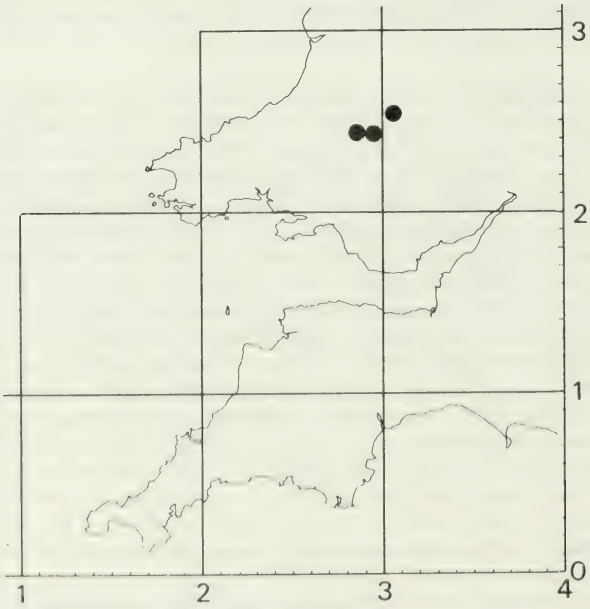

FIGURE 2. Distribution of *Rubus aquarum* Newton & Porter

Rubus gallofuscus Newton & Porter, **sp. nov.** (Series *Micantes*)

Turio altiarcuatus in apricis atropurpureus obtuse angulatus faciebus planis modice pilosus, glandulis mediocribus brevibusque, aciculis nonnullis, aculeis mediocribus tenuibus rectis, patentibus vel declinatis e basi compressa vinaceis apice croceo, aculeolis interdum glanduliferis obsitus. Folia quinata ± digitata superne strigosa inferne viridia velutina; foliolum terminale ± longe petiolatum late obovatum vel subrotundum vel pentagonum basi subcordata vel emarginata breviter acutum margine interdum undulata aequaliter serratum. Inflorescentia intricata late pyramidata ad apicem singulatim foliosa; ramuli medii cymosi in summa parte divisi c. 7-flori. Rachis vix flexuosa dense pilosa tomentosa aculeis tenuibus declinatis, aciculis nonnullis, glandulis brevibus mediocribus crebris armata. Flores 1·5–2 cm diam; sepala griseoviridia tomentosa breviter aciculata glandulifera patentia vel fructum laxe amplectantia. Petala obovata vel elliptica fimbriata alba haud contigua; stamina stylos aequantia vel vix superantia; filamenta alba; anthera glabra; carpella hirsuta; receptaculum ± glabrum. Fructus parvus sphaericus.

Stem arching, deep purple in exposure, round or bluntly angled with flat sides, with numerous short or medium simple or tufted whitish hairs, few or numerous sessile or very short stalked glands and stellate hairs, occasional to frequent short and medium stalked glands and a few acicles, numerous short-medium prickles grading into pricklets some gland-tipped, largest prickles c. 7–8 mm long, 10–15 per 5 cm, straight, slender, patent to declining from a compressed base, hairy, reddish-purple with straw coloured tips. Young shoots tinged with bronze or purple. Leaves mostly digitate or subdigitate; leaflets 5, usually not contiguous, dark green and shortly strigose above, mid green and thickly and softly hairy below with short simple hairs, some stellate hairs and sparse to frequent sessile glands; terminal leaflet medium to long stalked, broadly obovate round or pentagonal, about 6 × 5 cm, emarginate or slightly cordate at the base, usually abruptly narrowed at the apex to a short point (c. 1 cm); margin flat or undulate, serrate or slightly biserrate with fairly even rather short mucronate teeth of variable width; basal leaflets with stalks 4–7 mm; petioles longer than basal leaflets with about 10–15 falcate prickles (c. 3 mm), otherwise clothed and coloured as the stem. Flowering branch with 1–3 ternate leaves below with axillary peduncles of about the same length or shorter, then leafy to the apex with a series of diminishing simple leaves; inflorescence intricate when well developed, broadly pyramidal or cylindrical with a domed apex; middle peduncles branched above halfway, with about 7 flowers. Rachis slightly flexuose, coloured as stem, with frequent slender declining prickles (up to 4 mm), more densely hairy and felted than stems with patent short-medium simple or tufted hairs, frequent short to long stalked glands and some acicles. Pedicels with almost patent acicular prickles (up to 3 mm) otherwise clothed like the rachis but with shorter hairs and more numerous medium or long stalked glands. Flowers about 1·5–2 cm in diameter; sepals greyish-green, felted and with short spreading simple hairs, few to frequent short acicles and stalked glands, mainly reflexed in open flower and patent or clasping in fruit, those of the tip fruits developing long points; petals c. 10 × 6 mm, obovate to elliptical, white with a greenish claw, downy on the margin and both surfaces, not contiguous; stamens about the same length or slightly longer than green styles, filaments white, anthers glabrous; young carpels hairy; receptacle glabrous or slightly hairy. Fruit round, small. Flowering in July and August.

HOLOTYPE: field bank, Penrhos, Brecs., v.c. 42, GR 22/802.113, 2 August 1988, *M. Porter* (**NMW**).

This bramble appears to have been collected first by A. Ley in 1890 from Pont-nedd-fechan in Breconshire and later from various localities in surrounding counties. Several gatherings were seen by Rogers and usually determined as "*R. fuscus* Wh. and N. forma" and the bramble appears as *R. fuscus* var. *macrostachys* from v.c. 42 in Rogers (1900). It is the Mid-Wales representative of the "*Rubus fuscus* group" which includes eight named regional species from southern and central Britain as well as two local unnamed plants, in addition to *R. fuscus* Weihe and *R. insectifolius* Lef. & Mueller (*R. fuscus* var. *nutans* Rogers).

Representative exsiccata: Herefs., v.c. 36, Wormbridge, 24 August 1906, *A. Ley* (**NMW**). Glam., v.c. 41, Ystalyfera, July 1906, *H. J. Riddelsdell* (**NMW**); Resolven, 22 July 1984, *M.P.* (**herb. M.P.**); near Gurnos, 3 August 1988, *M.P.* (**herb. M.P.**). Brecs., v.c. 42, Pont-nedd-fechan, 30 July 1890 *A.*

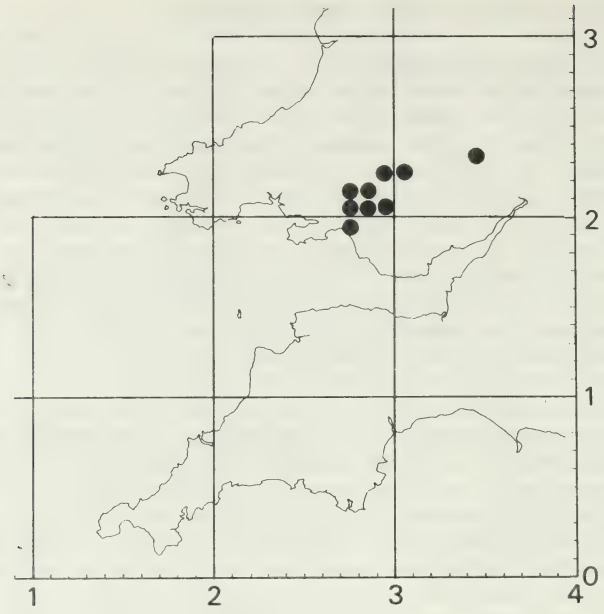

FIGURE 3. Distribution of *Rubus gallofuscus* Newton & Porter

Ley (**BIRM**), Ystradgynlais, 11 July 1906, *A. Ley* (**BIRM**); Heol Senni, 7 August 1906, *A. Ley* (**BIRM**, **NMW**, **OXF**); Heol Senni, 19 August 1947, *E. S. Edees* (**NMW**); Nant Senni, 21 July 1973, *A.N.* (**herb. A.N.**); Nant Llech, 2 September 1976, *M.P.* (**herb. M.P.**); Penrhos, 1 August 1977, *M.P.* (**herb. M.P.**); Cwmbrynich, 6 September 1977, *M.P.* (**herb. M.P.**); Cwm Giedd, 25 August 1978, *M.P.* (**herb. M.P.**). Carms., v.c. 44, Cwm Twrch, 7 July 1899, *A. Ley* (**BIRM**); Cwm Twrch, 2 August 1988, *M.P.* (**herb. M.P.**).

The known distribution is shown in Fig. 3.

Rubus biloensis Newton & Porter, **sp. nov.** (Series *Anisacanthi*)

Turio arcuatus tandem procumbens obtuse angulatus faciebus striatis planis vel leviter concavis, in umbrosis pallide viridis in apricis cinnabarinus parce pruinosus, leviter pilosus, aciculis nonnullis, glandulis numerosis inaequalibus, aculeis croceis pilosis brevibus vel mediis rectis vel raro curvatis e basi compressa declinatis plerumque ad angulos dispositis minoribus interdum glanduliferis armatus. Folia 3–5-nata pedata superne parce strigosa subplicata inferne capillis simplicibus interdum stellatis vestita. Foliolum terminale apice cuspidatum ellipticum vel subrotundum basi truncata vel subcordata aequaliter serratum dentibus majoribus vix prominentibus. Inflorescentia angusta rigida ad apicem haud foliosa superne racemosa pedunculis patentibus 1–3(–5)-flori. Rachis valida ± recta dense pilosa aculeis nonnullis declinatis pusillis glandulisque crebris obsita. Flores 2–2·5 cm diam. Sepala griseoviridia tomentosa glandulis aciculisque ornata patentia vel fructum amplectantia. Petala haud contigua fimbriata obovata pallide rosea; stamina stylos virides superantia; filamenta alba tandem rubescentia. Anthera glabra. Fructus mature rubiginosus.

Stem low-arching then prostrate, bluntly angled with flat or slightly concave sides, pale green in shade becoming orange-red in exposure, striate, slightly pruinose, with sparse to numerous medium or short simple or tufted hairs, occasional to frequent stalked glands of various lengths, sparse to numerous sessile glands and an occasional short acicle; prickles short to medium (3–7 mm) straight or rarely curved, declining from a compressed base, chiefly on the angles but not confined to them c.(10–)15–20 per 5 cm, yellow or orange-red with yellow tips, hairy, the smaller sometimes gland-

tipped; young shoots bronze in exposure. Leaves 3–5 nate, pedate, leaflets imbricate or not, ultimately mid-green above, paler beneath; thinly strigose above with sparse subsessile glands at first, hairy beneath with sparse to numerous simple hairs and sometimes stellate hairs; terminal leaflet short stalked, broadly obovate or elliptical, but rarely ovate, emarginate to narrowly cordate at the base and with a cuspidate often curved tip (c. 1·5 cm); fairly evenly serrate with main teeth slightly prominent; upper surface of leaf often becoming convex and sometimes plicate or rugose; basal leaflets with short stalks (to 5 mm); petiole usually rather longer than basal leaflets with about 10–15 small slanting or falcate prickles (c. 3 mm), clothed like the stem but with more numerous spreading simple hairs, stellate hairs and stalked glands. Flowering branch narrow, with 1–3 basal peduncles usually shorter than their ternate leaves and 1–2 simple leaves with short axillary peduncles; not leafy to apex; upper part of inflorescence simply racemose with middle and upper peduncles almost patent up to 2 cm long and bearing 1–3(–5) flowers. Rachis coloured as the stem, fairly stout and almost straight with few or many declining prickles (to 3 mm), densely clothed with spreading simple hairs and stellate hairs and frequent short to long stalked glands; pedicels with almost patent acicular prickles (to 3 mm), clothed like the upper part of the rachis but with more numerous medium to long stalked glands. Flowers 2–2·5 cm diameter; sepals greyish-green felted with medium or short spreading simple hairs and sparse to frequent short to medium stalked glands and acicles, short pointed, patent, erect to clasping in fruit; petals not contiguous, usually obovate, c. 14 × 8 mm, very pale pink with a greenish claw, downy on the back and margin; stamens slightly longer than the styles, filaments white, turning red after petal fall, anthers glabrous; styles green or pink-based; young carpels glabrous; receptacle hairy or glabrous; fruit coloured reddish-brown at early stage, with medium to large number of drupelets. Flowering in July and August.

Although the inflorescence is remarkably constant in form, there is considerable variation in the frequency of stalked glands, acicles and hairs on the stem.

HOLOTYPE: lane bank, Llanfillo, Brecs., v.c. 42, GR 32/117.333, 21 July 1988, *M. Porter* (**NMW**).

In 1975 an unfamiliar bramble was noticed in Llanfillo churchyard, Breconshire, and later was found growing in considerable quantity around the nearby Iron Age hill fort. Specimens sent to A. N. revealed that it was nameless. The following year two sheets of the same bramble, collected by A. Ley at Nant Tresglen, Breconshire, in 1906, were found in his herbarium at **BIRM**. These had been identified, probably by W. M. Rogers, as *R. longithyrsiger* Lees var. *botryeros* Focke. A duplicate gathering was later seen at **NMW**. During the last few years the same bramble has been found in several localities in Brecs., v.c. 42, and the adjacent vice-counties of Glam., v.c. 41, Rads., v.c. 43, Carms., v.c. 44 and Cards., v.c. 46. Recently it was discovered in N. Devon, v.c. 4, during a B.S.B.I. field meeting based at South Molton.

Although superficially similar to *R. leyanus* Rogers in some of its vegetative characters, its simple, narrow, columnar inflorescence with stout rachis bearing pale pink flowers is distinctive.

It has been named after the Celtic Saint Bilo to whom Llanfillo church is dedicated. She is reputed to have been one of the twenty four saintly daughters of King Brychan who ruled over the small Welsh kingdom of Brycheiniog, later known as Breconshire, in the 5th Century A.D.

Representative exsiccata: Brecs., v.c. 42, Nant Tresglen, 8 August 1906, *A. Ley* (**BIRM**, **NMW**); Llanfillo, 26 July 1978, *M.P.* (**NMW**); Allt Fillo, 26 July 1978, *M.P.* (**herb. M.P.**); Nant Gwennol, 28 July 1982, *M.P.* (**herb. M.P.**). Rads., v.c. 43, Penmaenau, 5 August 1988, *M.P.* (**herb. M.P.**); Cwmbach, 8 September 1988, *M.P.* (**herb. M.P.**). Carms., v.c. 44, Nant Gwennol, 28 July 1982, *M.P.* (**herb. M.P.**); Dolgran, 3 August 1987, *M.P.* (**herb. M.P.**); Dolaucothi, 3 August 1987, *M.P.* (**herb. M.P.**); near Ynys Wen, 25 August 1988, *M.P.* (**herb. M.P.**). Cards., v.c. 46, Lampeter, 20 July 1978, *M.P.* (**herb. M.P.**).

The known distribution is shown in Fig. 4.

Rubus merlini Newton & Porter, **sp. nov.** (Series *Hystrices*)

Turio arcuatus tandem procumbens obtuse angulatus faciebus planis, in apricis brunneo-roseus leviter pilosus glandulis mediocribus numerosis, aciculis glanduliferis nonnullis aculeisque tenuibus

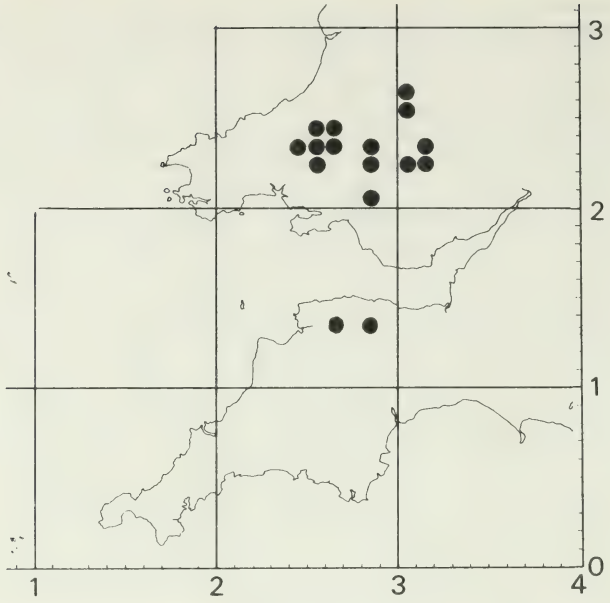

FIGURE 4. Distribution of *Rubus biloensis* Newton & Porter

rectis e basi lata declinatis amplitudine variabili omnino obtectus. Folia pedata quinata superne parce strigosa glabrescentia inferne leviter pilosa. Foliolum terminale brevipetiolatum ovatum basi cordata sensim acuminatum undulatum profunde duplicato-dentatum. Inflorescentia late pyramidata superne aphylla; ramuli medii 1–3(–5) flori pedunculis ± patentibus. Rachis recta capillis densis glandulis crebris amplitudine variis, aculeolis aciculisque patentibus numerosis obsita. Flores stellati c. 2·5 cm diam; sepala patentia vel fructum laxe amplectantia tomentosa glandulifera aciculata. Petala alba anguste obovata margine glabra; stamina stylos pallide virides vix superantia; filamenta alba, carpella glabra, receptaculum pilosum; fructus oblongus.

Stem medium-low arching then trailing, bluntly angled with flat sides, brownish-pink in exposure, slightly striate, thinly to moderately hairy with simple or clustered spreading hairs, few or numerous sessile glands and numerous short to medium stalked glands and few to many gland-tipped acicles. Prickles numerous on angles and faces, straight, slender, declining from a compressed base, ranging in size from slightly less than stem diameter down to c. 2 mm, about 10–15 of the large prickles per 5 cm. Young shoots golden or copper coloured. Leaves pedate; leaflets usually 5, contiguous or not, slightly strigose or glabrescent above, softly but sparsely hairy beneath. Terminal leaflet short-stalked, ovate, with cordate base and gradually acuminate apex, undulate margins usually distinctly jagged and sharply biserrate. Petiole about the same length or shorter than the basal leaflets, clothed as the stem except that the largest prickles (2–3 mm) are often falcate. Flowering branch broadly pyramidal, usually with 1–3 long ascending or divergent axillary branches more than half the length of the inflorescence subtended by ternate leaves at the base, 1–3 simple leaves above, not leafy to the apex; middle panicle branches with 1–3(–5) flowers on fairly long almost patent pedicels. Rachis straight, densely clothed with spreading simple or tufted hairs, short to long stalked glands, numerous patent subulate pricklets and acicles. Pedicels clothed as upper rachis but with more crowded pricklets and acicles and the hairs more adpressed so that the stalked glands appear more conspicuous. Flowers starry, about 2·5 cm diameter; sepals patent in open flower, patent or loosely clasping in fruit, long-pointed, densely clothed with simple and stellate hairs, short or medium stalked glands and frequent acicles; petals white c. 14 × 6 mm, narrowly obovate, sparsely hairy on the back but with glabrous margins; stamens slightly exceeding styles, filaments white, anthers glabrous; styles pale green, carpels glabrous; receptacle pilose. Fruit oblong of about 30 drupelets.

HOLOTYPE: roadside hedgebank, Cilycwm, Carms., v.c. 44, GR 22/751.396, 14 July 1973, *T. A. W. Davis* (**NMW**). ISOTYPE: **herb. A.N.**

This plant was collected by A. Ley at the end of the nineteenth century from several localities in Mid Wales (vide infra). The early gatherings were usually identified as *Rubus viridis* Kaltenb., and under that name the plant is included in Rogers (1900). It differs however in significant respects from this continental plant (for which the correct name is *R. iuvenis* van de Beek) as exhibited by Wirtgen's authentic specimens in **MANCH**. *R. merlini* forms a conspicuous member of the mid-Welsh bramble community, being widespread and frequent in v.cc. 42–44 & 46. It is easily distinguished by the very prickly stem, bright green attenuate terminal leaflets and white starry flowers. As it is particularly prevalent in the deciduous woods of Carms., v.c. 44, it has been named after the local sage Merlin who is associated with this area in many legends and after whom Carmarthen is named.

Representative exsiccata: Brecs., v.c. 42, Fannog, Nant Towy, 4 August 1897, *A. Ley* (**BIRM**); Dyffryn Crawnon, 27 June 1898, *A. Ley* (**BIRM**); Cwm Gwydderig, 8 August 1906, *A. Ley* (**BIRM**); Corryn Wood, Garth, 29 July 1977, *M.P.* (**herb. M.P.**); Nant Gwennol, 2 August 1977, *M.P.* (**herb. M.P.**); Llangoed, 15 July 1980, *M.P.* (**herb. M.P.**); Abergwesyn, 23 August 1980, *M.P.* (**herb. M.P.**). Myarth, Llangynidr, 17 August 1988, *M.P.* (**herb. M.P.**). Rads., v.c. 43, Cwm Elan, 2 August 1986, *A. Ley* (**BIRM**); Allt goch, 26 August 1892, *A. Ley* (**BIRM**, **MANCH**, **NMW**). Carms., v.c. 44, Pont Gwydderig, 5 August 1897, *A. Ley* (**BIRM**, **NMW**); Rhandirmwyn, 29 July 1962, *T. A. W. Davis* (**NMW**), Rhyd-y-groes, 28 July 1978, *T. A. W. Davis* (**NMW**), Abergorlech, 22 August 1988, *M.P.* (**herb. M.P.**). Cards., v.c. 46, Nant Doethi, 10 August 1897, *A. Ley* (**BIRM**).

The known distribution is shown in Fig. 5.

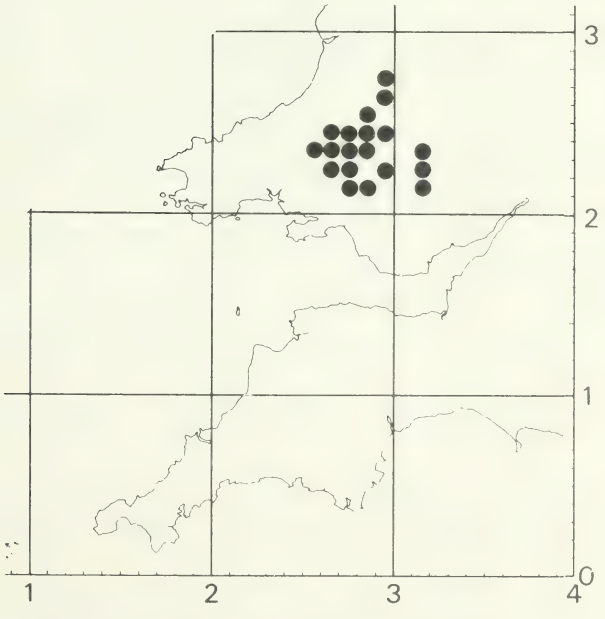

FIGURE 5. Distribution of *Rubus merlini* Newton & Porter

REFERENCES

EDEES, E. S. & NEWTON, A. (1988). *Brambles of the British Isles*. London.
ELLIS, R. G. (1983). *Flowering plants of Wales*. Cardiff.
NEWTON, A. (1972). A Welsh bramble foray. *Watsonia* **9**: 117–130.
NEWTON, A. (1974). Five brambles from South Wales. *Nature in Wales* **14**: 24–33.
NEWTON, A. (1976). Brambles in Glamorgan and neighbouring areas. *Trans. Cardiff Nat. Soc.* **97**: 44–50.
PRYCE, R. D. (1988). B.S.B.I. Rubus Meeting, Carmarthen, 1987. *B.S.B.I. Welsh Bulletin* **46**: 21–30.
RIDDELSDELL, H. J. (1907). A flora of Glamorganshire. *J. Bot., Lond.* **45**: Suppl.
ROGERS, W. M. (1899). Radnorshire and Breconshire Rubi. *J. Bot., Lond.* **37**: 193.
ROGERS, W. M. (1900). *Handbook of British Rubi*. London.
ROGERS, W. M. & LEY, A. (1906). New brambles from South Wales. *J. Bot., Lond.* **44**: 58.
SALTER, J. H. (1935). *The flowering plants and ferns of Cardiganshire*. Cardiff.
WATSON, W. C. R. (1950). *Yb. bot. Soc. Br. Isl.* **1950**: 47.
WATSON, W. C. R. (1958). *Handbook of the Rubi of Great Britain and Ireland*. Cambridge.

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Short Notes

HIERACIUM BRITANNICUM F. J. HANB. IN WALES

This taxon was described by Hanbury (1892). The description is clear, and conveys an accurate image of the plant that at the present time grows commonly on limestone rocks in Derbyshire. The distribution given by Hanbury (1892) mentions three vice-counties: Derbys. (v.c. 57), Staffs. (v.c. 39), and Mid-W. Yorks. (v.c. 64), and a possible fourth, Fife (v.c. 85). It is apparent from Hanbury's comments that the Yorkshire plant was slightly different.

Within a few years Hanbury (1895) was able to record the plant from at least ten vice-counties on the strength of specimens in his own or Mr Backhouse's herbarium. Unfortunately the details have not been published but it is reasonable to assume that specimens from some localities, particularly those in Wales, would have been assigned at a later date either to *H. subbritannicum* (A. Ley) Sell & West, first described as a variety of *H. stenolepis* in 1909, or *H. britanniciforme* Pugsley, described in 1941. The latter was first recognised as distinct by field botanists more than 40 years earlier.

The next expert to publish a summary of distribution was Linton (1905) who added Westmorland (v.c. 69) and Caerns. (v.c. 49) to the vice-counties given by Hanbury (1892). Hanbury had personally confirmed the identifications for these additional vice-counties, which were published in *J. Bot., Lond.* **32**: 304 (1894), and *Rep. botl Soc. Exch. Club Br. Isl.* **2**: 17 (1901), although from the description given the latter record refers to specimens of *H. britanniciforme*. This is confirmed by a specimen in herb. E. S. Marshall at **CGE**.

Hyde & Wade (1934) listed *H. britannicum* as occurring in two Welsh vice-counties, Brecs. (v.c. 42) and Caerns. (v.c. 49). It is clear from the opinions of Ley (1909) and Pugsley (1948) that the plants from Brecs. are correctly referred to the taxon now known as *H. subbritannicum*. The Caerns. record was based on specimens at the National Museum of Wales; examination of the specimens from Caerns. determined as *H. britannicum* now at **NMW** shows that they are *H. britanniciforme*, with the exception of two sheets, which remain undetermined due to their condition. The next expert to publish a statement about *H. britannicum* in Wales was Pugsley (1948) who on p. 117 stated when speaking of *H. britanniciforme*, "Both species grow on different parts of the Great Orme, *H. britannicum* as a very dwarf form."

Sell & West in Perring (1968) mapped the distribution of *H. britannicum* and showed many localities, but only in Staffs. and Derbys. Following this expert opinion, Ellis (1983) omitted any mention of this taxon as a Welsh plant, despite the record in Pugsley (1948).

On a visit to Llandudno on 13th and 14th May 1988, the writer had the good fortune to discover both species. A walk on the evening of the 13th led to the discovery of a small colony of *H. britannicum* on the limestone outcrops below Mynydd Pant. The following day *H. britanniciforme* was seen in quantity on the Great Orme, although *H. britannicum* was not observed.

It is interesting to note that Griffith (1895) recorded *H. britannicum* f. from Great Orme's Head and rocks above Bodafon, thus recording both areas where the taxa still occur. *H. britannicum* has also been discovered recently on one of the limestone outcrops between Llandudno and Derbyshire, paralleling the distribution of *H. holophyllum* and its variety *dentulum*. The former occurs in v.cc. 49 and 57, and the latter in v.cc. 36, 51, 57 and 64. *H. britannicum* is at present only known to occur in v.cc. 39, 49, 50 and 57.

The Cambridge University Herbarium (**CGE**) was examined in an attempt to discover any specimens supporting the early literature records of *H. britannicum* in the Llandudno area. The following specimens in the *H. britanniciforme* folders were considered by the writer to be *H. britannicum*:–

Caerns., v.c. 49: cliffs on Great Orme's Head, July 1871, *S. H. Bickham 5*; rock near Little Orme's Head, July 1893, *J. E. Griffith*; Great Orme's Head, August 1894, *J. E. Griffith* (a similar plant from the same gathering ex herb. Wheldon, now at **NMW**, is *H. britanniciforme*); near Glodaeth, lime rocks, 19th June 1901, *A. Ley*; Little Orme, lime rocks, 19th June 1901, *A. Ley*. (This sheet

has four specimens, three being *H. britannicum*, the remaining specimen possibly being *H. britanniciforme* although dark papillae are present on the styles.); south west side of the Great Orme's Head, exposed limestone rocks, 9th July 1912, *E. S. Marshall*. (This sheet has four specimens, and it may be that the two small flowering plants are *H. britanniciforme* as are the four small specimens collected by W. A. Shoolbred, on the same day, and now at **NMW**).

Denbighs., v.c. 50: GR. 23/832.797, Bryn Ewyn, Colwyn Bay, numerous, growing in cracks on south-facing limestone, altitude 350 ft., 15th June 1968, *J. M. Brummit*.

The characters used to diagnose *H. britanniciforme* in the field are the spotting on the broad, thick leaves which are purple on the underside, together with the relatively short peduncles and the large pale heads; the paleness of the heads is due to floccum (stellate hairs en masse) on the phyllaries. In *H. britannicum*, in contrast, spotting is absent, leaves are narrower and thinner with large basal teeth, which, when the plant is large, are very large. The heads are much darker in appearance because few stellate hairs are present and the peduncles are generally longer. In *H. britanniciforme* the styles are pure yellow, whereas in *H. britannicum* they are yellow but with dark papillae present, giving an overall impression of a dingy off-yellow. Examination of plants growing in situ is the easiest way to appreciate the differences between the taxa.

In herbarium material which has been poorly prepared it is difficult to separate the species. The spotting may have almost disappeared and large heads can shrink during drying if sufficient pressure is not maintained while the specimen is in the press. However, the simple hairs on the leaves are unaffected by drying and, in *H. britannicum*, are much thinner than in *H. britanniciforme*, where the hairs are nearly setose. The phyllaries, particularly of specimens collected late in the season, can look very similar, but in *H. britannicum* they are longer, thinner and tend to twist at the apex and have fewer glands or hairs on the section behind the apex, which is also often tinged faintly pink. *H. britannicum* is illustrated in Butcher (1961), from a specimen collected on Little Orme. The accompanying description indicates the identity to be correct.

To conclude, *H. britannicum* occurs at three sites on limestone in two vice-counties (49 and 50) in North Wales. It has persisted unnoticed by nearly all botanical visitors for 117 years, and should be looked for at suitable localities, particularly in Flints. (v.c. 51).

REFERENCES

Butcher, R. W. (1961). *A new illustrated British Flora*. London.

Ellis, R. G. (1983). *Welsh flowering plants*. Cardiff.

Griffith, J. E. (1895). *The flora of Anglesey & Carnarvonshire*. Bangor.

Hanbury, F. J. (1892). Further notes on *Hieracia* new to Britain. *J. Bot., Lond.* **30**: 366.

Hanbury, F. J. (1895). *The London catalogue of British plants*, part 1, 9th ed. London.

Hyde, H. A. & Wade, A. E. (1934). *Welsh flowering plants*. Cardiff.

Ley, A. (1909). Brecon and West Yorkshire Hawkweeds. *J. Bot., Lond.* **47**: 12.

Linton, W. R. (1905). *An account of the British* Hieracia. London.

Perring, F. H., ed. (1968). *Critical supplement to the Atlas of the British flora*. London.

Pugsley, H. W. (1948). A prodromus of the British *Hieracia*. *J. Linn. Soc. Lond. (Bot.)* **54**: 113–117.

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CARDAMINE AMARA L.: ITS OCCURRENCE IN MONTANE HABITATS IN BRITAIN

C. amara is usually considered to be a lowland species in Britain and Ireland although known to occur up to 450 m in Scotland (Clapham 1987). This altitudinal limit refers to Buchanan White's Perthshire record: "ascends to 1500 feet in lowland Forth" (White 1898). During the past five years for the *Flora of Cumbria* survey, the author has found this species very locally up to 540 m in the northern Pennines in Cumberland (v.c. 70) and up to 488 m in the eastern Lake District in Westmorland (v.c. 69). As it appeared likely that the Perthshire (v.c. 87) record was sited in the Ochil Hills, a search was made in 1989 and the altitudinal limit of *C. amara* extended to 610 m.

In the montane habitats of the northern Pennines and Lake District, *C. amara* is present in

bryophyte-dominated springs and flushes, and along the rills and streams issuing from them. *Epilobium alsinifolium* is an almost constant associate from 244 m upwards. *Chrysosplenium oppositifolium* and *Cochlearia officinalis* are usually present and *Cardamine pratensis*, *Montia fontana*, *Stellaria alsine* and *Veronica beccabunga* commonly so. The abundant bryophytes include *Bryum pseudotriquetrum*, *Cratoneuron commutatum*, *C. filicinum* and *Philonotis fontana*. *Saxifraga stellaris* is an associate at the highest Lake District site and *Carex rostrata* at one of the higher Pennine sites. Although *Saxifraga aizoides* occurs in some of the flush systems, it keeps to the bare gravelly areas from which *C. amara* is absent. In the Ochils, *C. amara* is locally common in similar spring and flush communities and on mossy rocks by burn sides, being associated with *Epilobium alsinifolium* from 228 m upwards. *Saxifraga hypnoides* is a not uncommon associate and *Epilobium anagallidifolium* with the rare moss *Splachnum vasculosum* occur at the highest site.

Elsewhere, *C. amara*, associated with *Epilobium alsinifolium*, has been noted at 228 m in the Howgill Fells in West Yorks. (v.c. 65) (G. Halliday pers. comm.). However in the Southern Uplands of Scotland, where *C. amara* ascends to 312 m in Selkirks. (v.c. 79) and 358 m in Roxburghs. (v.c. 80) in similar base-rich flushes, *E. alsinifolium* is absent.

There are obvious similarities between these British habitats and those described by Ellenberg (1988) from Central Europe, where *C. amara* is present in subalpine and alpine spring swamp communities up to over 2000 m. They are described under the *Montio-Cardamineta* and *Montio-Cardametalia* and have *Epilobium alsinifolium* and several other British higher plants present. The associated bryophytes are also similar.

Intensive sheep grazing occurs at all the British sites so that plants are dwarfed and rarely flower, although they have been seen to do so at 457 m on a flushed Pennine ledge, inaccessible to sheep. The winter-green basal leaves can be recognised throughout the year but care is needed to distinguish them from some variants of *Cardamine pratensis*, which ascends to the highest flushes and is the commonest *Cardamine* in this habitat in Britain. *C. amara* has a patchy distribution in Britain, being very rare in Wales and the Scottish Highlands, so that it is unlikely to occur there as a montane species. It is absent from the Moorhouse national nature reserve in the northern Pennines, and so is undescribed from the plant communities there (Eddy, Welch & Rawes 1969), although it occurs close to the western boundaries. This very local and sporadic occurrence, mostly as a stunted and sterile variant, explains why its presence as a montane British species has been overlooked for so long.

ACKNOWLEDGMENT

I should like to thank Dr G. Halliday for his help in the preparation of this note.

REFERENCES

Clapham, A. R. (1987). Cruciferae, in Clapham, A. R., Tutin, T. G. & Moore, D. M. *Flora of the British Isles*, 3rd ed., pp. 92–3. Cambridge.

Eddy, A., Welch, D. & Rawes, M. (1969). The vegetation of the Moorhouse national nature reserve in the northern Pennines, England. *Veget. Acta Geobot.* **16**(5–6): 239–284.

Ellenberg H. (1988). *Vegetation ecology of Central Europe*, 3rd ed., pp. 430–31. Cambridge.

White, B. W. (1898). *The flora of Perthshire*, p. 62. Edinburgh.

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THE DISTRIBUTION OF *CAREX APPROPINQUATA* SCHUMACHER (*C. PARADOXA* WILLD.) IN GREAT BRITAIN AND IRELAND

Carex appropinquata Schumacher is widespread in the wetlands of central and northern Europe, including Scandinavia, and extends into Asia as far as the Urals. Its distribution is, however, more scattered than that of its close ally *C. paniculata* L., for reasons not yet fully substantiated.

Ellenberg (1988) cites a survey by E. Bálatova-Tulačkova in Czechoslovakia as evidence that *C. appropinquata* requires more acid conditions than does *C. paniculata*, a view already taken by Jermy & Tutin (1968) and carried over, for lack of clear evidence to the contrary, into Jermy, Chater & David (1982). The conclusion is nevertheless surprising for, while *C. paniculata* is tolerant of a variety of soils, the greatest concentrations of *C. appropinquata* in the British Isles are in the basic fens of East Anglia and County Westmeath.

Observations in the field suggest that *C. appropinquata* is less tolerant of drought, shade and competition than is *C. paniculata*. When, as has frequently happened in East Anglia, a site dries out as a result of improved drainage, increased water extraction, or invasion by scrub, *C. appropinquata* is the first of the two to disappear.

The presence of this sedge in the British Isles was first established in 1841 when R. Spruce recorded it (as *C. paradoxa* Willdenow) from Heslington Fields near York. A year later D. Moore found it in Ireland at Ladestown near Lough Ennell, County Westmeath; and between then and the end of the century it was also recognised in a number of East Anglian fens as well as on canal sides where the counties of Middlesex, Hertfordshire and Buckinghamshire meet. A new chapter opened in 1928 when W. A. Sledge showed that a colony of sedge at Malham Tarn was this species (Turrill 1929), and in the last 25 years Dr R. W. M. Corner has found it in several places in the Scottish border counties, while the explorations of the late Miss E. Booth, C. Breen and Miss M. Scannell have doubled the total of Irish records. *Carex appropinquata* has also been reported from Pembrokeshire, but erroneously (Evans 1989).

This sedge may still have been overlooked elsewhere in the British Isles, for it is not always easy to distinguish it from *C. paniculata*. Depauperate variants of the latter may come very close to *C. appropinquata*, and a hybrid (almost wholly sterile) generally appears wherever the two grow together. In addition a tussocky form of *C. diandra* known as *C. pseudoparadoxa* S. Gibson, with a branched inflorescence, may confuse the issue (Sledge 1937), and it was this taxon that was responsible for the false reports from Wales.

The character usually cited as the main distinction between *C. appropinquata* and *C. paniculata* is the nature of the basal sheaths, which in *C. paniculata* are entire, red- to dark-brown and shiny, while in *C. appropinquata* they are black, matt, and eventually split into separate hair-like fibres; but the splitting hardly occurs until the sheath is dry and the plants are often growing in standing water. The leaves of *C. appropinquata* are a bright yellow-green and less than 2 mm broad, but those of a poor specimen of *C. paniculata* may be no wider than this. The glumes of *C. appropinquata* have a reddish tinge but this only becomes pronounced when the plant is dried. The safest guide is the shape of the utricle, more or less triangular with a broad serrated wing in *C. paniculata*, ovoid in *C. appropinquata* and abruptly narrowed into an unwinged beak. The utricle of *C. diandra* is narrowly winged, and the beak is split with the edges of the split overlapping.

All recorded stations in the British Isles have been visited since 1980, by myself or by botanists who may be considered wholly reliable. The state of each colony so observed is indicated in the following list by the letters A = up to 20 plants, B = 21 to 100, C = 101 to 1000, D = over 1000. Where the sedge has not been refound, the date and authority for the most recent sightings are given. The authenticity of specimens cited is confirmed by me.

[W. Sussex, v.c. 13: 51/2.1, Henfield, 1939, *J. E. Lousley* (**RNG**). In Borrer's garden and clearly one of the 'foreign' plants introduced there by him.]

Herts., v.c. 20: 51/0.9, Harefield, meadow near Copper Mills, 1885, *J. Benbow* (**BM**); [52/1.2, Hitchin, Oughton Head, 1921, *J. E. Little* (**CGE**), a puzzling sedge but certainly not *C. appropinquata*.]

Middlesex, v.c. 21: 51/0.7, West Drayton, canal, 1873, *J. L. Warren* (**BM**, **CGE**); 51/0.8, Uxbridge Moor, 1910, *C. B. Green* (**CGE**); 51/0.9, Harefield, formerly abundant in several places from Springfield Lock towards Rickmansworth but finally destroyed by gravel-digging c. 1936 (Kent 1975).

Bucks., v.c. 24: 51/0.8, near Denham, 1905, *G. C. Druce* (**BM**, **CGE**), destroyed by railway works c. 1925.

W. Suffolk, v.c. 26: 52/7.7, Icklingham Poors Fen (B); Cavenham, 'fen valley wood' (= Ash Plantation), 1952, *S. M. Walters* (**CGE**); between Mildenhall and Eriswell, 1938, *E. Nelmes* (**K**), probably same as 'Bombay Fen', since destroyed; 52/7.8, Eriswell, Caudle Fen (Trist 1979), ploughed in the 1970s; Brandon, Fenhouse Heath, 1956, F. Rose, and Palmer's Heath, 1975, A.

O. Chater & Mrs G. Crompton, now gone; 52/9.7, Market Weston Fen, last seen 1960 (Simpson 1982).

E. Norfolk, v.c. 27: 62/4.9, between Haddiscoe and Somerleyton, 1955, F. Rose, exact site not traceable; 63/0.0, Hingham, Seamere (A), declining; 63/3.0, Aldercarr Fen (C), Wheatfen (C), and Parish Marsh (C); Strumpshaw (B); 63/3.1, Hoveton Great Broad (A); Hoveton Little Broad, 1975, F. Rose; Ranworth, west (C), east (D); Upton Broad, south (D), north (C); Woodbastwick Fen, three areas (A, B, C); Horning Fen, 1950, F. Rose; 63/3.2, Dilham Broad Fen (C); Barton Great Fen, 1902, *C. E. Salmon* (**BM**), may = Catfield Great Fen (C); Stalham, Wood Marsh, 1902, *C. E. Salmon* (**BM**); Longmoor Point, Middle Fen (C) and Sutton Broad Fen (D); 63/4.0, Acle Decoy Carr, 1955, F. Rose; 63/4.1, Thurne, Shallam Dyke, 1956, *J. F. M. & M. J. Cannon* (**BM**), now drained; 63/4.2, Hickling, 1888, *A. H. Evans* (**BM**); between Palling Wood and Horsey, 1956, T. G. Tutin, exact site not traceable.

W. Norfolk, v.c. 28: 52/9.8, Middle Harling (A); Overa Heath, 1963 (Petch & Swann 1969), area since reclaimed; 52/9.9, Hockham, Cranberry Rough (B); Thompson Common (A); Stow Bedon Fen, 1926, *T. J. Foggitt* (**BM**); 53/6.1, Wormegay, Mow Fen (B); Shouldham Warren, east end, 1919, *J. E. Little* (**CGE**), extinct by 1943 (Petch & Swann 1969); 53/8.0, Great Cressingham, 1966, E. L. Swann, access now denied; 53/9.0, Scoulton Mere, before 1926, H. D. Hewitt (Petch & Swann 1969); 53/9.2, Guist Fen (C); 53/9.3, Sculthorpe Moor, 1985, C. P. Petch, one plant, formerly more plentiful; 62/0.9, Swangey Fen (A); Old Buckenham Fen, 1956, F. Rose.

Cambs., v.c. 29: 52/5.7, Wicken Fen (B), formerly "abundant", 1885, *A. Fryer* (**BM**).

[Pembs., v.c. 45: 12/7.2, the records for Pwll Trefeiddan, Dowrog Common and Caerfarchell are all referable to *C. diandra*.]

[Derbys., v.c. 57: 43/2.4, near Shirley Mill, error for *C. paniculata* (Linton 1903).]

E. Yorks., v.c. 61: 44/6.4, Heslington Fields, 1846, *W. W. Newbould* (**BM**); Langwith Common, 1852, *S. Thompson* (**BM**), both sites drained by end of century; 54/0.4, Beverley, Pulfin Bog, 1968, R. W. David (A), now almost certainly lost under carpeting *Phragmites* and *Glyceria*; [54/0.5, of two specimens from Driffield, collected 1898 and 1903 by C. Waterfall and in **BM** determined by A. Bennett as *C. appropinquata*, the first is *C. diandra* and the second *C. disticha*; while a recent report from the same area is not supported by a specimen;] 54/1.4, Leven Canal, 1953, Miss M. E. Crackles (A), now gone; 54/1.7 or 2.7, Flamborough Head, 1912 (Robinson 1914), never confirmed.

Mid-W. Yorks., v.c. 64: 34/8.6, Malham Tarn Fen, east (B), west (D); 44/5.4, between Heelaugh and Askham Richard (Lees 1888); Askham Bog (B).

[N. W. Yorks or Co. Durham, v.c. 65 or 66: 35/9.2, unlocalised, 1947, N. Brownbridge, 10-km card at Biological Record Centre, not accepted by Perring & Walters (1962).]

Peebless., v.c. 78: [36/1.4, Medwen, a specimen collected 1979 by D. J. McCosh and at first thought to be *C. appropinquata* has now been determined as *C. paniculata*;] 36/2.3, Innerleithen, The Glen, 1858, Lyell (Balfour 1925), never confirmed.

Selkirks., v.c. 79: 36/3.1, Clearburn Loch, one plant; Alemoor Back Loch, two places (A,B); Alemoor Loch, north (B).

Roxburghs., v.c. 80: 36/3.1, Alemoor Loch, south (B); 36/4.1, Branxholme Wester Loch (B); 36/4.2, Dunhog Moss (B); 36/5.1, Adderstonlee Moss (B).

[Mid Ebudes, v.c. 103: Mull, the record in Clapham, Tutin & Warburg (1952) is an error (Jermy & Crabbe 1978).]

[N. Ebudes, v.c. 104: 17/1.5, Gunna, 1940 (Heslop-Harrison 1941) is almost certainly an error.]

Co. Clare, v.c. H.9: 11/3.7, Dromoland (C).

Co. Carlow, v.c. H.13: 21/8.8, Rahill Bog, 1973, Miss E. M. Booth, site destroyed before 1978.

Offaly, v.c. H.18: 22/0.1, Lough Coura (B).

Westmeath, v.c. H.23: 22/0.4, Killinure Lough, west (A); 22/1.4, Twy Bog (B); Lough Makeegan (C); 22/2.4, south-east of Lough Sawdy (C); 22/2.5, Lough Sawdy, west side (A); near Glencarry House (A); 22/2.6, Ballynacarrow, reported 1958 but specimen in **TCD** is *C. diandra*; 22/3.4, Lough Ennell, western shore (C); 22/3.5, Monroe (B); Mount Dalton Lake (C); south of Kenny (C); Royal Canal, Kilpatrick Bridge (A); 22/3.6, Lough Iron (C); Lough Owel, Bunbrosna (D); 22/4.4, Lough Ennell, eastern shore, two plants; Lough Ennell, Ladestown (C); 22/4.5, Lough Ennell, Bog of Linn (C); Tullaghan Bog (D); Lough Owel, south-eastern corner (C); Royal Canal, east of Mullingar (C); Scraw Bog (B); 22/4.6, Ballinafid Lough (C).

REFERENCES

BALFOUR, F. R. S. (1925). Botany, in BUCHAN, J. W. *A history of Peeblesshire* **1**: 338. Glasgow.
CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. (1952). *Flora of the British Isles*. Cambridge.
ELLENBERG, H. (1988). *Vegetation ecology of Central Europe*, 4th edition, translated by G. K. Strutt. Cambridge.
EVANS, S. B. (1989). *Carex appropinquata* in Pembs., v.c. 45 – a misidentification for *C. diandra*. *B.S.B.I. News* **53**: 17–18.
HESLOP-HARRISON, J. W. (1941). The flora of the isles of Coll, Tiree and Gunna, *Proc. Univ. Durham phil. Soc.* **10**: 302.
JERMY, A. C., CHATER, A. O. & DAVID, R. W. (1982). *Sedges of the British Isles*. London.
JERMY, A. C. & CRABBE, J. A. (1978). *The Island of Mull, a survey of its flora*, p. 11.68. London.
JERMY, A. C. & TUTIN, T. G. (1968). *British sedges*. London.
KENT, D. H. (1975). *The historical flora of Middlesex*. London.
LEES, F. A. (1888). *The flora of West Yorkshire*. London.
LINTON, W. R. (1903). *Flora of Derbyshire*, p. 296. London.
PERRING, F. H. & WALTERS, S. M., eds. (1962). *Atlas of the British flora*. London.
PETCH, C. P. & SWANN, E. L. (1969). *Flora of Norfolk*. Norwich.
ROBINSON, J. F. (1914). Botanical report. *The Naturalist* **1914**: 32–33.
SIMPSON, F. W. (1982). *Simpson's Flora of Suffolk*. Ipswich.
SLEDGE, W. A. (1937). *Carex pseudoparadoxa* S. Gibson. *Rep. botl Soc. Exch. Club Br. Isl.* **11**: 358–361.
TRIST, P. J. O. (1979). *An ecological flora of Breckland*. Wakefield.
TURRILL, W. B. (1929). Report of the distributor for 1928. *Rep. botl Soc. Exch. Club Br. Isl.* **8**: 930–931.

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THE CUMBRIAN HERBARIUM OF W. H. YOUDALE

Liverpool Museum (**LIV**) recently acquired W. H. Youdale's herbarium of Cumbrian flowering plants and ferns. Youdale was a draper who lived in Cockermouth, Cumbria (Collins & Pound 1988). Little was hitherto known of Youdale's botanical activities and, although he was a contemporary of W. Hodgson of Workington, the author of *Flora of Cumberland*, there is no reference to Youdale in this Flora, nor to his published records from Silloth (Youdale 1892). However, his herbarium specimens provide ample evidence that he undertook a thorough survey of the Cockermouth and Allonby areas of Cumberland (v.c. 70), with occasional forays further afield to St Bees, Sellafield, Honister Pass and Coniston.

Youdale's herbarium is well preserved and is mounted on standard-sized sheets. A short note appeared in *B.S.B.I. News* (Allen 1987) which gave the size of the collection as no more than 175 sheets; the correct number, excluding undetermined scraps and a small collection made by Miss McGlasson from Hyères, S. France in December 1894, is 314 sheets.

The collections were amassed over a period of 18 years. Youdale's own gatherings cover the years 1891 to 1908 (excluding 1901 and 1905). His collaborators were as follows:
T. Brown, 1892, 1894; J. P. Dalton, September 1891; James Dobbins, 1892, 1893; Rev. Hilderic Friend, 1894–96; Mr Postgate, July 1902; J. Scott, August 1907; W. West jnr, May, June & August 1891; F. Yeomans, June 1901; George Yeomans, 1891–93, 1895, 1901, 1904, 1908; L. M. Youdale, August & September 1893; Mrs W. H. Youdale, July 1892.

It is possible that the last two collectors listed are the same person. Of the eleven or twelve collectors represented in the herbarium, only two, Rev. Hilderic Friend and William West jnr, are listed in Kent & Allen (1984). William West's specimens were collected from Caernarvonshire, Hertfordshire and Surrey. The Rev. Hilderic Friend was a Methodist minister who was allotted the Cockermouth circuit for three years around 1895 (Friend 1943), and he botanised widely in Britain. His collections occur in a number of public herbaria (Kent & Allen 1984). With these exceptions, the botanists whose collections are represented in Youdale's herbarium confined their activities to western Cumberland, an area for which few collections exist from this period. The relevant tetrads, and those visited by Youdale himself, are shown in Fig. 1.

From a total of 314 named and localised specimens, 246 were collected by Youdale alone; a small

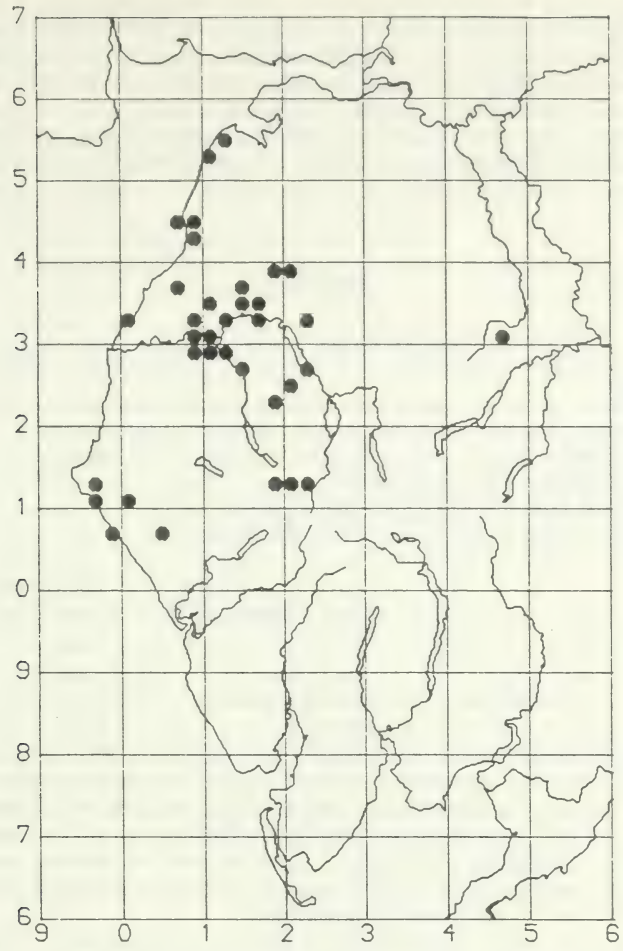

FIGURE 1. Distribution of localities of Cumbrian specimens represented in the W. H. Youdale herbarium, shown as tetrads.

number was collected jointly by Youdale and Friend. The majority of specimens are of widespread native species. There are, however, a small number of aliens present, some of which were collected from around the docks in Silloth (GR 35/12.52). An example is *Hesperis matronalis* L. Other records from Silloth Docks include two species now extinct in v.c. 70: *Agrostemma githago* L. and *Arabis glabra* (L.) Bernh. The latter species was also recorded by Friend (1895, 1896) as *Turritis glabra* L. from near Cockermouth, where he claimed it was native.

There are a number of records of non-native species from "wood behind South Lodge, Cockermouth, *T. Brown*" which are the first records for v.c. 70. These are all species which could be expected to have persisted in, or escaped from, gardens: *Centaurea montana* L., *Euphorbia lathyrus* L., *Laburnum anagyroides* Medic., *Ruta graveolens* L. and *Salvia argentea* L., the latter two not having been subsequently recorded in the county. *Turgenia latifolia* (L.) Hoffm. from "Stackyard, Dubb Mill, Allonby, August 1894, *W. H. Youdale*" is also the first record for v.c. 70, the only other record being from Carlisle in 1905 where it was found by T. S. Johnstone. Another first record is of *Prunus lusitanica* L., collected by W. H. Youdale from a plantation at Holmwood, Cockermouth in June 1894.

Youdale's record of *Centaurium littorale* (D. Turner) Gilmour is, surprisingly, from an inland

site, "near the summit of the Hay, Cockermouth, September 16, 1891, alt. 700 ft". *Atriplex glabriuscula* Edmondston from "sea shore near Dubb Mill, Allonby, August 1894, *W. H. Youdale*" is the first v.c. 70 voucher specimen for this scarce seaside plant. *Salvia verticillata* L. was recorded for v.c. 70 by Youdale from Skinburness in July 1896 and from Silloth Docks in August 1907. It still occurs at Silloth Docks, its only extant locality in the vice-county.

Among the notable records published in Youdale's only known botanical article (Youdale 1892) was *Crithmum maritimum* L. from the coast south of Silloth. This is the only Cumberland record from north of St Bees Head, but there is no voucher specimen in his herbarium.

REFERENCES

Allen, D. E. (1987). A local herbarium for sale. *B.S.B.I. News* **47**: 32.

Collins, J. & Pound, E. (1988). *Natural history, science & medicine*: Catalogue no. 1090, item no. 6433, Maggs Bros. Ltd. London.

Friend, H. (1895). *Turritis glabra*, etc., in the Lake District. *The Naturalist*, August 1895: 238.

Friend, H. (1896). Tower Cress near Cockermouth. *The Naturalist*, August 1896: 256.

Friend, J. W. (1943). Hilderic Friend (1852–1940). [Obituary]. *N.W. Naturalist* **18**: 117–119.

Hodgson, W. (1899). *Flora of Cumberland*. Carlisle.

Kent, D. H. & Allen, D. E. (1984). *British and Irish herbaria*. London.

Youdale, W. H. (1892). Silloth in August. *Sci. Gossip* **28**: 14–15.

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ALOPECURUS BULBOSUS GOUAN IN DORSET

Alopecurus bulbosus Gouan is relatively easy to see for two or three weeks from mid-May when it is flowering, but very hard to find later in the season. FitzGerald (1989) showed that it still survives at many sites in south-eastern England where it had not been recorded for many years. Inspired by knowledge of her fieldwork, I searched for the plant in Dorset (v.c. 9) in the summer of 1989. The results were similarly encouraging, showing that, while the grass has certainly been lost at some sites because of urban expansion, agricultural improvement and reduced salinity, much of the apparent decline is because the plant is not actually looked for.

Another reason for the search was to look for the hybrid *Alopecurus* × *plettkei* Mattfeld (*A. bulbosus* × *geniculatus*), reported from as far west as Christchurch Harbour (Trist & Wilkinson 1989). In both of the Dorset sites where the hybrid was found it was growing both a little further from the sea and a little higher above HWMOT in a less open community.

The results of the searches are given below. In addition, all the likely salt-marsh areas of the Fleet were investigated, but with no success other than at the new site at Rodden. Though it may seem rash to say so, there are few other likely sites in the county, although it is odd that there are no other records from the southern shores of Poole Harbour. The following list details the Dorset sites searched for the occurrence of *Alopecurus bulbosus* in 1989 in grid reference order from the west. (The names in brackets refer to field records collected and held at the Dorset Environmental Record Office in Dorchester, with the exception of those of Mansel-Pleydell referred to below.)

Seatown, GR 30/42.91 (*H. J. M. Bowen 1950*). Not refound. Site now a car park.

West Bay, GR 30/463.905 (*R. Good 1936*). Many thousands of plants over meadow apparently now used only for a summer fair. By far the best site in the county (**herb. D.P.**).

Burton Bradstock, GR 30/476.897 (*R. Payne 1981*). In small quantity amongst caravans behind shingle bar (**herb. D.P.**).

Burton Mere, GR 30/509.878 (*Graveson 1956*). Many hundreds of plants over 0·5 km but all specimens examined were the hybrid *A.* × *plettkei* (**herb. D.P.**).

West Bexington, GR 30/528.867 & 523.871 (*R. McGibbon 1985* – this is Mansel-Pleydell's "Swyre" site). In small quantity to the east of the extensive reedbed, and in greater quantity to the west (**herb. D.P.**).

Abbotsbury, GR 30/572.842 & 568.842 (*R. Walls 1986*). In abundance in open field to north-west of Swannery. The next field to the west produced only the hybrid – this field was much more overgrown with richer vegetation (both **herb. D.P.**).

Rodden Hive, GR 30/604.823. A new site. Abundant both on edge of Fleet and at the seaward end of a newly ploughed field with no other vegetation (**herb. D.P.**).

Radipole, GR 30/67.79 (*H. J. M. Bowen 1963*). Not refound. The salinity is dropping as a result of sluices, although *Carex divisa* still present. All of the other old sites in Weymouth are long since built over.

Lodmoor, GR 30/688.814 (*H. J. M. Bowen 1955*). Refound in one small area, but as access to this R.S.P.B. reserve is very difficult there may well be more.

Piddle Marshes, GR 30/93.88 (*D. Ranwell 1965*). Not visited, access is very difficult.

Redcliffe, GR 30/939.873 (*R. Good 1936, etc.*). Only a few plants were found in one area. The rest of the grazing marshes have been steadily improved.

Swineham, GR 30/943.879 (*D. Ranwell 1965*). A few plants.

Keysworth, GR 30/947.897 (*R. McGibbon 1985*). A very few plants in one small area. It is odd that the vast areas of grassland on the north-western shore of Poole Harbour produces only this one patch.

The Moors, Arne, GR 30/94.89 (*D. Ranwell 1965*). Ranwell described this in 1965 (Card Index at I.T.E., Furzebrook) as "Optimum development over several areas, almost pure sward locally". As mentioned above the grazing marshes have been improved and although there are still patches of *Juncus maritimus* with a poor grass flora, there was no sign of any *A. bulbosus*.

Poole, GR 40/01.90 (Mansel-Pleydell 1895). Marsh near Railway Station. Presumably long since built over.

Swanage, GR 40/02.79 (Mansel-Pleydell 1895). Presumably long since built over.

There is little to be added to FitzGerald's (1989) excellent notes on associations. Suffice it to say that *Carex divisa* was found in most of the western sites, but *Ranunculus baudotii* only at the hybrid site at Burton Mere. The other associates were much as described by her. The Rodden site (colonizing a ploughed field) was most interesting: the site abutted closed *Phragmites* marsh on the other side of the stream to the main colony, and it seemed as though saline turf had been ploughed. However, the site must have been too saline for the new ley to germinate, as opposed to the rest of the field inland, and the result was that there was no vegetation other than *A. bulbosus*, which is scattered over an area of 10 m^2. Its fate is awaited with interest.

ACKNOWLEDGMENTS

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REFERENCES

FitzGerald, R. (1989). 'Lost and Found' – *Alopecurus bulbosus* Gouan in S.E. England. *Watsonia* **17**: 425–428.
Mansel-Pleydell, J. C. (1895). *Flora of Dorset*. Dorchester.
Trist, P. J. O. & Wilkinson, M. J. (1989). *Alopecurus* × *plettkei* Mattfeld in Britain. *Watsonia* **17**: 301–307.

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THE ORIGIN AND TAXONOMY OF *SPARTINA* × *NEYRAUTII* FOUCAUD

The salt marsh grass *Spartina* × *townsendii* H. & J. Groves is well known as the hybrid progenitor of *Spartina anglica* Hubbard, the 'classic' example of a recently evolved allopolyploid species. Marchant (1967, 1968) concluded that the available historical, morphological, and cytological

evidence on the status of *S.* × *townsendii* is entirely consistent with it being a hybrid between *S. maritima* (Curtis) Fernald, a native of England, and *S. alterniflora* Loiseleur, a species introduced into Southampton Water from the United States in the early 1800s. The hybridisation appears to have occurred at Hythe, Hampshire, presumably just before the first discovery of *S.* × *townsendii* in 1870. The nature of the origin has recently been confirmed beyond all reasonable doubt by the use of isozyme markers (Raybould 1989; Raybould *et al.*, in press.).

What appears to be a similar event has been recorded from the coasts of south-western France and northern Spain. *S. maritima* is a native of the area, and *S. alterniflora* was introduced by shipping (presumably independently of the English introduction); the first record is from 1806 near the mouth of the River Bidassoa (Hubbard, Grimes & Marchant 1978). In 1892 Neyraut collected plants at Hendaye (Mobberley 1956), which he believed to be identical to *S.* × *townsendii* (Chevalier 1923). However, Foucaud (1984) described the variants found by Neyraut as a new species, *S. neyrautii* Foucaud.

Since the discovery of *S. neyrautii* there has been doubt over its true status (see Marchant (1977) for a full discussion of the arguments), the most generally accepted conclusion being that the taxon is a hybrid between *S. maritima* and *S. alterniflora*, but that it can be distinguished from British *S.* × *townsendii* on morphological grounds. One possible explanation for this difference is that *S.* × *townsendii* and *S.* × *neyrautii* are reciprocal hybrids (Arber 1934). To investigate the matter further, a search was made for *S.* × *neyrautii* in 1970 (Hubbard, Grimes & Marchant 1978). Apparently the only remaining site for *S.* × *neyrautii* was in a small area of salt marsh adjacent to San Sebastian airport. Marchant (1977) compared the morphology of these plants with *S.* × *townsendii* from England and concluded that *S.* × *neyrautii* was "not referable to *S.* × *townsendii*". However, for each of the vegetative characters considered, the range given for each taxon overlaps in every instance. Marchant also presented cytological data from the two taxa. They both have the same

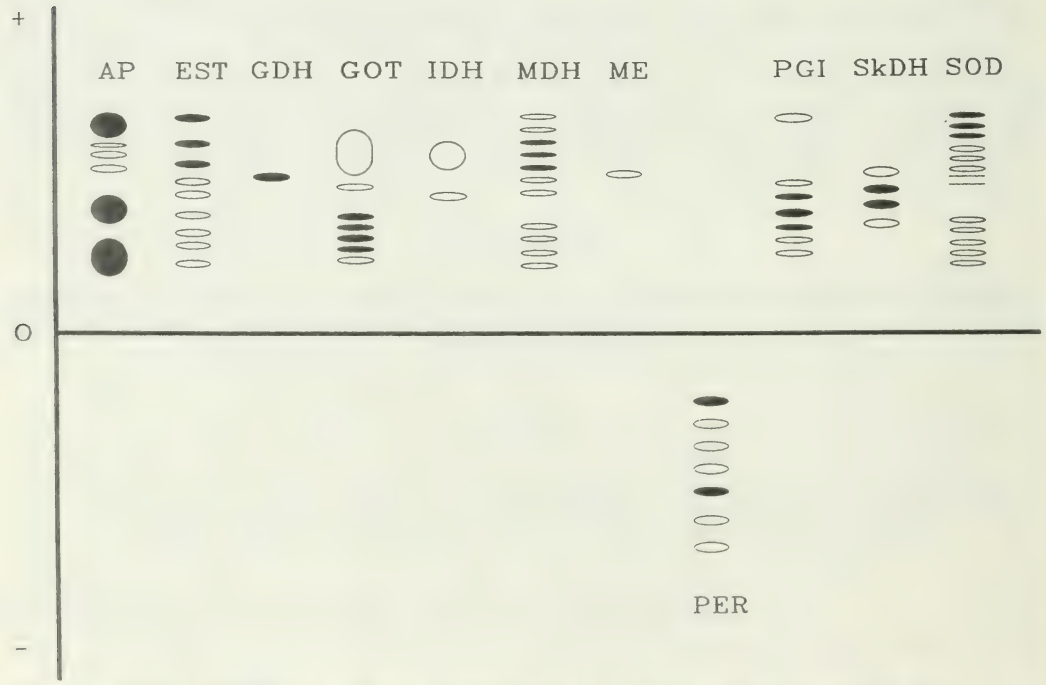

FIGURE 1. Common phenotype of *Spartina* × *townsendii* and *S.* × *neyrautii* for eleven isozyme systems. Abbreviations: AP – acid phosphatase, EST – esterase, GDH – glutamate dehydrogenase, GOT – glutamate oxalacetate transaminase, IDH – isocitrate dehydrogenase, MDH – malate dehydrogenase, ME – malic enzyme, PER – peroxidase, PGI – phosphoglucose isomerase, SkDH – shikimic acid dehydrogenase, SOD – superoxide dismutase.

chromosome number of 2n=62 and very similar chromosome pairing behaviour, although *S.* × *neyrautii* has a slightly higher frequency of multivalents. These data strongly support the idea that, like *S.* × *townsendii*, *S.* × *neyrautii* is a hybrid between *S. maritima* and *S. alterniflora*.

To confirm this hypothesis we obtained isozyme phenotypes from a clone of *S.* × *neyrautii* which had been collected in Spain by Hubbard *et al.* and has since been kept in cultivation first at the Coastal Ecology Research Station in Norwich and subsequently at the John Innes Institute. We have previously shown (Raybould *et al.*, in press) that twelve clones of *S.* × *townsendii* from the Hythe population when examined for eleven isozyme systems showed no variation and phenotypes which are entirely consistent with *S.* × *townsendii* being a hybrid between *S. maritima* and *S. alterniflora*. The isozyme phenotypes of *S.* × *neyrautii* for these eleven systems were obtained using the same methodology and were found to be completely identical with those of *S.* × *townsendii*. These systems resolved into over 70 bands and may well represent the products of at least 50 loci (Fig. 1). This extensive evidence confirms the nature of *S.* × *neyrautii* as a hybrid between *S. maritima* and *S. alterniflora* and also shows that the actual parents of the two hybrids were identical with respect to these isozyme systems.

This result raises three points. First, it at least suggests that *S. maritima* may be highly uniform genetically throughout its whole range. It has previously been shown that this species has very low levels of genetic variability in Britain (Raybould 1989). Second, the two introductions of *S. alterniflora* into Europe appear also to be very similar genetically. Third, *S.* × *townsendii* and *S.* × *neyrautii* are synonyms because they have the same parentage; the former has priority.

ACKNOWLEDGMENTS

We should like to thank Dr A. Smith of the John Innes Institute for her gift of the *Spartina* × *neyrautii* clone used in this study. A.F.R. gratefully acknowledges the financial support of an N.E.R.C. (C.A.S.E.) studentship.

REFERENCES

Arber, A. (1934). *The Gramineae*. Cambridge.

Chevalier, A. (1923). Note sur les *Spartina* de la flore français. *Bull. Soc. bot. Fr.* **70**: 54–63.

Foucaud, M. (1894). Un *Spartina* nouveau. *Ann. Soc. Nat. Sci. Rochelle* **31**: 8.

Hubbard, J. C. E., Grimes, B. H. & Marchant, C. J. (1978). Some observations on the ecology and taxonomy of *Spartina* × *neyrautii* and *Spartina alterniflora* growing in France and Spain and comparison with *Spartina* × *townsendii* and *Spartina anglica*. *Doc. Phytosociol., New Ser.* **2**: 273–282.

Marchant, C. J. (1967). Evolution in *Spartina* (Gramineae). I. History and morphology of the genus in Britain. *Bot. J. Linn. Soc.* **60**: 1–24.

Marchant, C. J. (1968). Evolution in *Spartina* (Gramineae). II. Chromosomes, basic relationships and the problems of the *S.* × *townsendii* agg. *Bot. J. Linn. Soc.* **60**: 381–409.

Marchant, C. J. (1977). Hybrid characteristics in *Spartina* × *neyrautii* Fouc., a taxon rediscovered in northern Spain. *Bot. J. Linn. Soc.* **74**: 289–296.

Mobberley, D. (1956). Taxonomy and distribution of the genus *Spartina*. *Iowa St. Coll. J. Sci.* **30**: 471–574.

Raybould, A. F. (1989). *The population genetics of* Spartina anglica *C. E. Hubbard*. Ph.D. thesis, University of Birmingham.

Raybould, A. F., Gray, A. J., Lawrence, M. J. & Marshall, D. F. The evolution of *Spartina anglica* C. E. Hubbard (Gramineae): Origin and genetic variation. *Biol. J. Linn. Soc.* (in press).

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RUMEX ACETOSA L. SUBSP. *BIFORMIS* (LANGE) VALDÉS-BERMEJO & CASTROVIEJO IN BRITAIN

Many years ago I described and illustrated a coastal cliff ecotype of *Rumex acetosa* L., based on the following specimen in the Cambridge University herbarium (**CGE**): Cornwall, Zennor, 20 July

1839, *C. C. Babington* (Rechinger 1961). I wrote: "a very similar if not identical plant observed by myself in July 1959 in similar habitats along the north coast of Spain, Cabo Penas near Santander . . . it looks very distinctive, especially when alive, but I still hesitate to give it taxonomic recognition as my field experience is limited to one locality in northern Spain and as I have seen only one good herbarium specimen from Britain."

Since then, the Spanish plant in question has been identified by Valdés-Bermejo & Castroviejo (1977) as *R. acetosa* subsp. *biformis* (Lange) Valdés-Bermejo & Castroviejo. There are beautiful full-page illustrations of this taxon by Lange (1861, 1867).

When recently visiting north-western Spain I was fortunate to observe and collect subsp. *biformis* at the following localities in the province of La Coruña:

Cabo Finisterre, littoral siliceous rocks, 7.7.1988, *K. H. Rechinger 64750* (**W**); Cabo Toriniana, littoral siliceous rocks, 17.7.1988, *K. H. Rechinger 64784* (**W**); Cabo Vilano, 5km NW Carmarinas, granitic rocks, 18.7.1988, *K. H. Rechinger 64842* (**W**).

As can be seen from the type locality quoted below, my Spanish specimens come from the classical area. Here follows a description of my plants from the ditio classica.

Rumex acetosa L. subsp. **biformis** (Lange) Valdés-Bermejo & Castroviejo in *Anales Inst. Bot. A. J. Cavanilles* **34**: 326 (1977).

R. biformis Lange in *Index Sem. Hort. Haun.* 26 (1857). TYPE: In rupibus maritimis prope oppidum La Coruña Galiciae, 10. vii. 1852, *Lange*.

Stems (10–)15–30 cm high, usually several ascending from an indurate branching rootstock; base sometimes horizontally elongated. Basal leaves thick, fleshy and shiny when alive, thick leathery when dried, (20–)30–40(–50) × (8–)15–20(–30) mm, ovate-hastate, with very short, acute, sometimes obtuse and reduced basal lobe; petiole as long as or up to 1·5 times as long as the blade. Stem leaves few (1–)2–4, oblong-hastate, up to 4 times as long as broad, with very short acutish or obtuse basal lobes, short petiolate to sessile. Inflorescence short and dense, with few undivided erect or slightly divergent branches, only the lower ones sometimes remote. Valves 4–5 × 3–5·5 mm.

In all the Spanish localities of the litoral subspecies, the populations appeared to be completely isolated from any inland populations of *R. acetosa*. No transitional variants have been observed.

It might be worthwhile for British botanists to revisit the old Cornish locality and to look for new ones along the south-western coasts of Britain. I have no doubts about the identity of the Cornish plant with the northern Spanish *R. acetosa* subsp. *biformis*, which evidently is an Atlantic geographical race. Its distribution is comparable to that of *R. rupestris* Le Gall, a relative of *R. conglomeratus* Murr. (section *Rumex*).

REFERENCES

LANGE, J. M. C. (1861). *Vidensk. Meddel. Dansk Naturk. Foren. Kjöbenhavn* **1861**: 48–49.

LANGE, J. M. C. (1867). *Descriptio iconibus illustrata plantarum novarum vel minus cognitarum praecipue e Flora Hispania*, t.24. Copenhagen.

RECHINGER, K. H. (1961). Notes on *Rumex acetosa* L. in the British Isles. *Watsonia* **5**: 64–66 & pl. 4,5.

VALDÉS-BERMEJO, E. & CASTROVIEJO, S. (1977). Notas cariosistemáticas sobre Flora Española: 2. *Anales Inst. Bot. A. J. Cavanilles* **34**: 325–334.

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A NEW HYBRID BINOMIAL IN *MIMULUS* L.

As was shown by Roberts (1964), the hybrid between *M. guttatus* DC. and *M. luteus* L. s.l. is widespread in Britain and frequently confused with its parents. It occurs in extensive, clonal

populations independently of its parents and clearly merits its own binomial epithet. Although the present author is currently preparing a full account of *Mimulus* in Britain, there is a need for early publication of a name for this hybrid. The view is taken here that the '*luteus*' parent is *M. luteus* var. *rivularis* Lindley, though there are good reasons for considering this taxon as not being conspecific with the typical *M. luteus*, which does not occur in Britain.

In view of the fundamental contribution made by R. H. Roberts to the understanding of naturalised *Mimulus* taxa, and since he published an account of this particular hybrid, it is appropriate that he be commemorated by the choice of epithet.

Mimulus × **robertsii** Silverside, **hybr. nov.**
HOLOTYPUS: Hethpool, College Burn, Northumberland, v.c. 68, GR 36/895.280, in hill stream, 10th August 1989, *Silverside 1989/159* (**E**).

Hybrida ex *M. guttatus* DC. et *M. luteus* var. *rivularis* Lindley orta. Planta sterilis. Corollae flavae, palatis rubro-guttatis, lobis frequenter rubro-maculatis. Calyces basibus sparse hispidulis. Pedicelli sparse hispiduli, infimi calycibus 1–3plo longiores. Folia ovata vel ovato-rhombea apicibus acutis vel subacutis, dentata, saepe dentibus acutis, patentibus vel subantrorsis, et obscuris alternantibus. Bracteae late ovatae, dentatae. Stolones crassi breves, foliis mediocribus.

A sterile hybrid, variably intermediate between the parents. Corollas yellow, palates red-spotted, lobes commonly unmarked, as in *M. guttatus*, or else blotched with red on the labellum or on all five lobes. Pedicels and calyx-bases minutely and usually sparsely hispid. Lower pedicels up to three times as long as their calyces at maturity. Leaves ovate or ovate-rhomboid with acute or subacute apices, dentate, often with acute, patent to subantrorse teeth alternating with shallow, indistinct teeth. Bracts broadly ovate, dentate. Stolons short and thick, with the leaves not noticably different in size from other cauline leaves.

M. guttatus normally differs from superficially similar clones of the hybrid in its more rounded, crenately toothed leaves, its small, suborbicular, entire-margined upper bracts, its more elongated inflorescences, the horizontally held labella of newly-opened flowers and in its conspicuously inflated fruiting calyces. This last character may, however, be seen in some clones of the hybrid, though no seed is matured. The long, slender, small-leaved stolons produced in some abundance by *M. guttatus* in the late summer and autumn have not yet been observed in any clone of its hybrids.

M. luteus var. *rivularis*, a very local plant of hill streams in north-eastern England and southern and central Scotland, is a smaller, neater, mat-forming plant, with usually paler, more darkly blotched corollas, few-flowered inflorescences, pedicels often more than five times the length of their fruiting calyces and with leaf-teeth often more than twice as long as wide and somewhat twisted. The pedicels and calyces are normally entirely glabrous but in hot weather and in greenhouse cultivation they become minutely glandular-puberulent.

The type of material of *M.* × *robertsii* is from a clone with blotches on all five corolla-lobes and with rather blunt leaf-teeth somewhat approaching those of *M. guttatus*.

M. × *robertsii* is widespread in northern and western Britain and is often the only taxon present along upland river systems. It is only very locally established in the south-east and is apparently rare, or under-recorded, in Ireland. *Mimulus* 'A. T. Johnson' is a horticultural clone of the hybrid, frequently sold for bog and rock gardens, collected by Mr Johnson from a boggy stream in the Welsh hills before 1935 (Thomas 1980).

The above description must be taken to exclude certain plants with large, very broad leaves and with very heavily blotched, broader corollas. These plants, locally established in a few areas of Scotland, are hybrids involving *M. variegatus* J. St-Hil. (Silverside 1981).

Although *M.* × *robertsii* is described above as sterile, Parker (1975) reported a *Mimulus* population from the Lleyn peninsula in N. Wales with pollen fertility exceeding 70% and which on cytological grounds he regarded as a variant of this hybrid.

CHOICE OF TYPE MATERIAL

The hybrid of *M. cupreus* Dombrain and *M. luteus* var. *rivularis* (i.e. *M.* × *maculosus* T. Moore) is at least partially fertile and can be further crossed with *M. guttatus* to produce a sterile triple hybrid.

Roberts (1968) found that some artificially produced clones of this hybrid were indistinguishable from what is here called *M.* × *robertsii*. The present author has carried out similar crosses and has also produced plants that would be taken to be *M.* × *robertsii*, though most such triple hybrids are instantly recognisable. It follows that type material for *M.* × *robertsii* has had to be carefully selected. The College Valley, Northumberland, is a site where *M. luteus* var. *rivularis* occurs, along with at least three different clones of *M.* × *robertsii*. The occurrence of multiple clones of *M.* × *robertsii* is a phenomenon that is also linked with the presence of *M. luteus* var. *rivularis* in other localities, and it appears highly probable that they represent spontaneous local hybridisation. Living material of *M. luteus* var. *rivularis* collected in the College Valley by J. E. Halfhide and the author in 1975 was subsequently used for much experimental work and at least two generations of plants were obtained through self-fertilisation. No segregation of *cupreus*-characters was observed. Artificial hybridisations using this material and *M. guttatus* produced a range of products including one closely similar to the College Valley clone that has been selected as the source of the type material.

REFERENCES

PARKER, P. F. (1975). *Mimulus* in Great Britain – a cytotaxonomic note. *New Phytol.* **74**: 155–160.
ROBERTS, R. H. (1964). *Mimulus* hybrids in Britain. *Watsonia* **6**: 70–75.
ROBERTS, R. H. (1968). The hybrids of *Mimulus cupreus*. *Watsonia* **6**: 371–376.
SILVERSIDE, A. J. (1981). *Mimulus* L., in WIGGINTON, M. J. & GRAHAM, G. G., eds. *Guide to the identification of some of the more difficult vascular plant species. Nature Conservancy Council England Field Unit Occasional Paper No. 1*: 81–84.
THOMAS, G. S. (1980). A. T. Johnson. *The Garden* **105**: 484–488.

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NEW NAMES AND COMBINATIONS IN THE BRITISH FLORA

The six following names are required for forthcoming floristic publications:

1. **Ulmus minor** Miller subsp. **sarniensis** (C. Schneider) Stace, **comb. et stat. nov.**
U. glabra f. *sarniensis* C. Schneider, *Ill. Handb. Laubholzk.* **1**: 220 (1904).
This new combination was made invalidly by Stace (1989), the basionym given there being a *nomen nudum*.

2. **Mentha** × **villosa** Hudson var. **nicholsoniana** (Strail) R. Harley, **comb. nov.**
M. nicholsoniana Strail in *Rep. botl Soc. Exch. Club Br. Isl.* **1**: 186 (1888).
M. × *villosa* Hudson is the correct name for the hybrid combination *M. spicata* L. × *M. suaveolens* Ehrh., of which var. *nicholsoniana* is a distinctive pubescent variant with lanceolate-oblong leaves with a more or less acuminate apex and teeth that are not or scarcely folded under.

3. × **Tripleurothemis** Stace, **nothogenus nov.**
Hybridae inter *Tripleurospermum* Schultz Bip. et *Anthemis* L.
This intergeneric combination is the only British one known to me that does not already have a nothogeneric name.

4. × **Tripleurothemis maleolens** (P. Fourn.) Stace, **comb. nov.**
× *Anthemimatricaria maleolens* P. Fourn., *Fl. Compl. Plaine Franç.* 274 (1928).
This appears to be the correct binomial for *Tripleurospermum inodorum* (L.) Schultz-Bip. × *Anthemis cotula* L., the only combination so far recorded in Britain in the nothogenus × *Tripleurothemis*.

5. **Veronica reptans** Kent, **nom. nov.** pro *Veronica repens* Clarion ex DC. in Lam. & DC., *Fl. Franç.*, 3rd ed., **3**: 727 (1805); non *V. repens* Gilib., *Fl. Lit. Inch.* **1**: 108 (1781), nom. illegit.

6. **Schoenoplectus** × **kuekenthalianus** (Junge) Kent, **comb. nov.**
Scirpus × *scheuchzeri* Bruegger in *Jahresber. Naturf. Ges. Graubündens* **23/24**: 119 (1878–1880), non Vitman, *Summa pl.* **1**: 150 (1790).
S. × *kuekenthalianus* Junge in *Jahrb. Hamburg Wiss. Anst.* **22**, Beih. **3**: 73 (1905).
Schoenoplectus × *scheuchzeri* Palla ex Janchen, *Cat. fl. austr.* **1(4)**: 752 (1960).
This new combination is required for the hybrid *Schoenoplectus tabernaemontani* × *S. triqueter*.

ACKNOWLEDGMENTS

I am grateful to D. H. Kent for pointing out that my earlier *Ulmus* combination was invalid and for other help, and to R. M. Harley and D. H. Kent for publishing their contributions in this note.

REFERENCE

Stace, C. A. (1989). New combinations in the British and Irish Flora. *Watsonia* **17**: 442–444.

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Watsonia, **18**, 214–228 (1990)

Plant Records

Records for publication must be submitted to the appropriate Vice-county Recorder (see *Vice-county Recorders* (1988)), and *not* the Editors. The records must normally be of species, hybrids or subspecies of native or naturalized alien plants belonging to one or more of the following categories: 1st or 2nd v.c. record; 1st post-1930 v.c. record; only extant v.c. locality, or 2nd such locality; a record of an extension of range by more than 100 km. Such records will also be accepted for the major islands in v.cc. 102–104 and 110. Only 1st records can be accepted for *Rubus*, *Hieracium* and hybrids. Records for subdivisions of vice-counties will not be treated separately; they must therefore be records for the vice-county as a whole. Records of *Taraxacum* are now being dealt with separately by Dr A. J. Richards, and will be published at a later date.

Records are arranged in the order given in the *List of British vascular plants* by J. E. Dandy (1958) and his subsequent revision (*Watsonia*, **7**: 157–178 (1969)). All records are field records unless otherwise stated. With the exception of collectors' initials, herbarium abbreviations are those used in *British and Irish herbaria* by D. H. Kent & D. E. Allen (1984).

Records from the following vice-counties are included in the text below: 2, 4–8, 11, 12, 14, 16, 21, 25, 26, 29, 33, 35, 37–39, 41, 43–47, 50, 52–54, 64, 67, 68, 72, 73, 75–77, 79–81, 83, 93, 94, 96–99, 103, 108, H35, H36, H40.

The following signs are used:

* before the record: to indicate a new vice-county record.
† before the species number: to indicate that the plant is not a native species of the British Isles.
† before the record: to indicate a species which, though native in some parts of the British Isles, is not so in the locality recorded.
[] enclosing a previously published record: to indicate that the record should be deleted.

1/4. LYCOPODIUM CLAVATUM L. ***52**, Anglesey: Parys Mountain, GR 23/44.90. D. F. Evans, 1989, **NMW**, det. G. Hutchinson.

1/5. DIPHASIASTRUM COMPLANATUM subsp. ISSLERI (Rouy) Jermy **96**, Easterness: Strath Nethy, GR 38/0.0. Amongst *Calluna*. D. J. Tennant, 1981, **E**, det. A. C. Jermy. 2nd record.

4/1. EQUISETUM HYEMALE L. **39**, Staffs.: North-east of Upper Arley, GR 32/77.81. Stream banks in deciduous woodland. R. Maskew, 1989, **herb. B.R. Fowler**, det. J. M. Camus. 1st record since 1863.

4/6 × 10. EQUISETUM PALUSTRE L. × E. TELMATEIA Ehrh. ***52**, Anglesey: Traeth Lligwy, GR 23/49.87. Stabilised dune sand. R. H. Roberts, 1989. ***72**, Kirkcudbrights.: Tarras Water, GR 35/39.83. Wooded, marshy slope. M. E. R. Martin & O. M. Stewart, 1989, **E**, det. C. N. Page.

19/1. CYSTOPTERIS FRAGILIS (L.) Bernh. **7**, N. Wilts.: South Wraxall, GR 32/82.63. Stonework of bridge. J. Presland, 1987. 1st record since 1941.

21/2. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins **53**, S. Lincs.: Nocton Wood, GR 53/08.63. Primary woodland. N. Hards, 1984. 2nd record.

21/2 aff. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins subsp. AFFINIS **75**, Ayrs.: Troon, GR 26/3.3. T. Wise, n.d. but c.1900, **GL**, det. C. R. Fraser-Jenkins. 2nd record.

21/2 bor. DRYOPTERIS AFFINIS subsp. BORRERI (Newman) Fraser-Jenkins **75**, Ayrs.: Kelburn Glen, GR 26/22.56. A. R. Church, 1989. 2nd record.

21/2 cam. DRYOPTERIS AFFINIS subsp. CAMBRENSIS Fraser-Jenkins ***41**, Glam.: Bwlch y Clawdd, GR 21/9.9. C. R. Fraser-Jenkins, 1988. **75**, Ayrs.: Kelburn Glen, GR 26/22.56. A. R. Church, 1989. 2nd record.

21/6. DRYOPTERIS CARTHUSIANA (Vill.) H. P. Fuchs **93**, N. Aberdeen: Horntowie, GR 38/48.46. Moss. D. Welch, 1989, **ABD**. 2nd record.

[24/5. GYMNOCARPIUM ROBERTIANUM (Hoffm.) Newman **96**, Easterness: Delete record published in *Watsonia* **17**: 464 (1989), specimen is *G. dryopteris* (L.) Newman, det. A. C. Jermy.]

26/1. PILULARIA GLOBULIFERA L. ***53**, S. Lincs.: Swanholme, GR 43/94.68. Old sand and gravel pit. I. Weston, 1985. Whisby, GR 43/92.67. Recently abandoned sand pits. N. F. Stewart, 1987. 1st and 2nd records. **75**, Ayrs.: Loch Maberry, GR 25/28.75. Loch margin. H. A. Lang, 1984. Only extant locality.

†27/1. AZOLLA FILICULOIDES Lam. **26**, W. Suffolk: Whatfield, GR 62/02.46. Village pond. E. M. Hyde, 1988. 2nd record. ***H36**, Tyrone: Lough Neagh south of Farsnagh Point, GR 23/96.39. P. Corbett and R. S. Weyl, 1988.

29/1b. OPHIOGLOSSUM AZORICUM C. Presl ***11**, S. Hants.: Warwick Slade, GR 41/26.06. A. J. & B. Rackham, 1984, **BM**. Beaulieu Old Airfield, GR 41/35.00. R. P. Bowman, 1987, **herb. R.P.B.** 1st and 2nd records, both det. A. C. Jermy & A. M. Paul.

46/5. RANUNCULUS ARVENSIS L. **7**, N. Wilts.: Near Corston, GR 31/91.82. Weed in nursery. J. Hall, 1985. Only extant locality.

46/20. RANUNCULUS CIRCINATUS Sibth. **81**, Berwicks.: Kettleshiel Burn, GR 36/69.51. Gravelly burn. M. E. Braithwaite, 1989, **herb. M.E.B.** 2nd extant locality.

46/22a. RANUNCULUS AQUATILIS L. **94**, Banffs.: Portsoy, GR 38/59.64. Ditch. J. Edelsten, 1987, **E**, det. S. D. Webster. 1st post-1930 record.

46/22b. RANUNCULUS PELTATUS Schrank **7**, N. Wilts.: Oaksey, GR 31/98.92. Pond. M. A. R. & C. Kitchen, 1987, det. D. Green. Only extant locality.

†51/off. PAEONIA OFFICINALIS L. ***77**, Lanarks.: Shiels, GR 26/53.66. Grassy bank. P. Macpherson, 1985, **herb. P.M.** Still present in 1989.

†53/agg. BERBERIS AGGREGATA C. Schneider ***12**, N. Hants.: Stonerwood Park, Steep, GR 41/73.25. Hanger above Ridge Farm. J. D. Fryer, 1985, **herb. J.D.F.**, det. J. M. Mullin.

†54/1. MAHONIA AQUIFOLIUM (Pursh) Nutt. **94**, Banffs.: Forglen, GR 38/69.52. Neglected garden. T. C. G. Rich, 1987. 2nd record.

57/1. CERATOPHYLLUM DEMERSUM L. **83**, Midlothian: Dunsapie Loch, GR 36/28.73. Eutrophic lake. D. R. McKean, 1988, **E**. Only extant locality. ***H36**, Tyrone: Ballagh Lough, GR 23/50.50. Lake. R. S. Weyl, 1982.

65/3. CORYDALIS CLAVICULATA (L.) DC. ***77**, Lanarks.: Deanside, Glasgow, GR 26/52.65. Heath remnant. P. Macpherson, 1989, **herb. P.M.**

66/6b. FUMARIA MURALIS subsp. BORAEI (Jordan) Pugsley **38**, Warks.: Sherbourne, GR 42/25.62. Waste ground. A. Newton & J. C. Bowra, 1987, **WAR**, det. M. G. Daker. 1st record since 1872.

†67/3. BRASSICA RAPA L. **94**, Banffs.: 6 km N. of Aberchirder, GR 38/62.58. Roadside verge. J. Edelsten, 1987, **E**, det. T. C. G. Rich. 2nd record.

†67/jun. BRASSICA JUNCEA (L.) Czern. ***38**, Warks.: Leamington Spa, GR 42/33.65. Allotment. J. W. Partridge, 1986, **WAR**, det. A. L. Grenfell. Digbeth, Birmingham, GR 42/08.85. Roadside. J. W. Partridge, 1988, **WAR**, det. T. C. G. Rich. 1st and 2nd records.

†67/tou. BRASSICA TOURNEFORTII Gouan ***38**, Warks.: Coventry, GR 42/32.80. Allotment. Leamington Spa, GR 42/32.63. Allotment. Both J. W. Partridge, 1989, **herb. T.C.G. Rich**, det. T.C.G.R. 1st and 2nd records.

[†70/2. SINAPIS ALBA L. **93**, N. Aberdeen: Delete record published in *Watsonia* **16**: 144 (1987), specimen at **ABD** is *Raphanus raphanistrum* L.]

†71/1. HIRSCHFELDIA INCANA (L.) Lagrèze-Fossat **38**, Warks.: Nechell's Green, Birmingham, GR 42/08.87. Waste ground. J. W. Partridge, 1988, **WAR**, det. J. C. Bowra. 2nd record.

†74/3. RAPHANUS SATIVUS L. **50**, Denbs.: Near Tregeiro, GR 33/17.33. Shingley river bank. J. A. Green, 1989, **NMW**. 2nd record.

75/1. CRAMBE MARITIMA L. **45**, Pembs.: Broomhill Burrows, GR 12/88.00. Shingle. P. Rhind, 1989. Single plant. Only extant locality.

79/6. LEPIDIUM LATIFOLIUM L. †**38**, Warks.: Birmingham Inland Port, GR 42/09.87. Railway sidings. J. W. Partridge, 1989, **WAR**, det. T. C. G. Rich. 2nd record.

83/1. IBERIS AMARA L. **12**, N. Hants.: Porton Ranges, GR 41/24.37. Bare chalk of rabbit scrapings. D. Graiff, 1988. Only extant locality.

97/4 × 1. CARDAMINE FLEXUOSA With. × C. PRATENSIS L. ***38**, Warks.: Balsall Street, GR 42/22.76. Swampy meadow. J. W. Partridge, 1989, **herb. T. C. G. Rich,** det. T.C.G.R.

98/2. BARBAREA STRICTA Andrz. ***25**, E. Suffolk: Oulton Broad, GR 62/50.92. Mud dredged from river. J. M. Tusting, 1989, **herb. T.C.G. Rich**, det. T.C.G.R.

102/5 × 4. RORIPPA PALUSTRIS (L.) Besser × R. AMPHIBIA (L.) Besser ***38**, Warks.: Stratford upon Avon, GR 42/20.54. Mud in reed bed. J. W. Partridge, 1989, **herb. T.C.G. Rich**, det. T.C.G.R.

102/†6 × 3. RORIPPA AUSTRIACA (Crantz)Besser × R. SYLVESTRIS (L.)Besser ***98**, Main Argyll: Loch a'Mhuilin, GR 17/85.29. Waste ground. B. H. Thompson, 1987 and 1989, **herb. B.H.T.**, det. T. C. G. Rich. 1st Scottish and 2nd British record.

†RHUS TYPHINA L. **41**, Glam.: Lower Swansea Valley, GR 21/6.9. Cycle trackway. G. Hutchinson, 1989, **NMW**. 2nd record.

115/6. HYPERICUM MACULATUM subsp. OBTUSIUSCULUM (Tourlet) Hayek **25**, E. Suffolk: Beccles, GR 62/43.92. By disused railway line. P. G. Lawson & F. W. Simpson, 1987. Only extant locality.

115/6 × 5. HYPERICUM MACULATUM Crantz × H. PERFORATUM L. ***38**, Warks.: Leek Wootton, GR 43/30.69. Rough grass. J. W. Partridge, 1989, **WAR**, det. N. K. B. Robson. ***67**, S. Northumb.: Near Briarwood, GR 35/79.62. Roadside. G. A. & M. Swan, 1989, **herb. G.A.S.**, det. N. K. B. Robson. ***68**, Cheviot: North bank of R. Coquet near Rothbury, GR 46/05.01. River bank. G. A. Swan, 1989, **herb. G.A.S.**, det. N. K. B. Robson.

133/1b. STELLARIA NEMORUM subsp. GLOCHIDISPERMA Murb. †***45**, Pembs.: Withy Bush, Haverfordwest, GR 12/95.16. Weed in flower bed. S. B. Evans, 1989. Probably imported with forestry bark mulch.

†141/6. ARENARIA BALEARICA L. ***73**, Kirkcudbrights.: Below Shambellie House, New Abbey, GR 25/96.66. Wall. O. M. Stewart, 1989.

†153/1. AMARANTHUS RETROFLEXUS L. **4**, N. Devon: East Putford, GR 21/38.19. Arable field. W. H. Tucker, 1989. 2nd record.

†156/7. ATRIPLEX HALIMUS L. ***5**, S. Somerset: Blue Anchor, GR 31/00.44. Behind sea wall. Lady R. FitzGerald, 1989.

156/lon. ATRIPLEX LONGIPES Drejer ***35**, Mons.: R. Wye below Chepstow, GR 31/53.93. River bank. M. A. R. & C. Kitchen, 1988, det. J. R. Akeroyd.

156/pra. ATRIPLEX PRAECOX Hülphers ***108**, W. Sutherland: Badnabay, GR 29/22.46. Muddy track to salt marsh. E. Norman, 1988, **BM**.

160/nit. SALICORNIA NITENS P. W. Ball & Tutin ***68**, Cheviot: Alnmouth, GR 46/24.09. Upper salt-marsh. G. A. Swan, 1989. Holy Island, GR 46/10.43. Upper salt-marsh. G. A. Swan & M. Swan, 1989. 1st and 2nd records, both det. I. K. Ferguson.

162/2. TILIA CORDATA Miller ***8**, S. Wilts.: Whiteparish Common, GR 41/24.22. Bank. D. W. Soden, 1986, det. P. M. Woodruffe.

†168/2. GERANIUM MACRORRHIZUM L. ***39**, Staffs.: Ettinghall, GR 32/92.95. Waste mine site. C. B. Westall, 1988.

†170/6. OXALIS ARTICULATA Savigny ***75**, Ayrs.: Ardrossan Castle Rock, GR 26/23.43. Long grass. A. Rutherford & A. McG. Stirling, 1989.

†170/exi. OXALIS EXILIS A. Cunn. ***38**, Warks.: Leamington Spa, GR 42/32.65. J. W. Partridge, 1988, **WAR**, det. M. F. Watson. Stretton-on-Fosse, GR 42/22.38. Footpath. J. C. Bowra, 1989, **WAR**, det. P. J. Copson. 1st and 2nd records. **81**, Berwicks.: Longformacus, GR 36/69.57. Pavement. M. E. Braithwaite, 1989, **herb. M.E.B.** 2nd record.

†171/3. IMPATIENS PARVIFLORA DC. ***35**, Mons.: Twyn Lane, Glascoed, GR 32/33.01. Lane banks. R. Fraser, 1989.

185/1. GENISTA TINCTORIA L. **45**, Pembs.: Moory Farm north of Redberth, GR 22/07.05. *Molinia* – dominated heathy pasture. H. Harries & R. Elliot, 1989, det. S. B. Evans. 2nd record.

185/2. GENISTA ANGLICA L. **80**, Roxburghs.: Brotherstone Hill, GR 36/61.36. *Calluna* heath. R. W. M. Corner, 1989, **herb. R.W.M.C.** 1st record since 1890.

190/1 × †2. MEDICAGO FALCATA L. × M. SATIVA L. ***77**, Lanarks.: Govan, GR 26/59.63. Waste ground by road. P. Macpherson, 1988, **herb. P.M.**, det. P. J. O. Trist.

190/4. MEDICAGO MINIMA (L.) Bartal. †***12**, N. Hants.: Blackmoor Fruit Farm, GR 41/76.32. Arable weed. Lady A. Brewis, 1988. Introduced with shoddy but established for at least 14 years.

192/19. TRIFOLIUM FRAGIFERUM L. ***39**, Staffs.: Stafford Common, GR 33/92.25. Short turf in pasture. S. Lawley, 1989, **herb. B. R. Fowler.**

†193/1 pol. ANTHYLLIS VULNERARIA subsp. POLYPHYLLA (DC.) Nyman ***29**, Cambs.: Near Burwell, GR 52/57.65. Bank of old railway line. P. D. Sell, 1966, **CGE**, det. J. R. Akeroyd.

†206/7. VICIA VILLOSA subsp. VARIA (Host) Corb. **6**, N. Somerset: Odd Down, Bath, GR 31/74.62. Waste ground. D. E. Green, 1988, **herb. E. J. Clement**, det. E.J.C. 1st record since 1917.

206/12. VICIA LUTEA L. †**7**, N. Wilts.: Wanborough Plain, GR 41/22.80. Roadside verge. J. Newton, 1988, **herb. D. Green.** Only extant locality.

207/6. LATHYRUS SYLVESTRIS L. **43**, Rads.: Burfa Bank, GR 32/28.60. Scrub on wooded hillside. D. R. Humphreys, 1989. Only extant locality.

†208/1. PHYSOCARPUS OPULIFOLIUS (L.) Maxim. ***H36**, Tyrone: Glenlark, GR 23/57.87. Riverside. J. Harron, 1987. Well established. 1st Irish record.

†209/alb. × 2. SPIRAEA ALBA Duroi × S. DOUGLASII Hooker ***73**, Kirkcudbrights.: South of Corse, GR 25/67.76. O. M. Stewart, 1980. ***77**, Lanarks.: Cathkin, GR 26/62.58. Roadside. P. Macpherson, 1989, **herb. P.M.**, det. A. J. Silverside.

210/1. FILIPENDULA VULGARIS Moench ***75**, Ayrs.: Knockdaw Hill, Colmonell, GR 25/16.88. Amongst heather on serpentine. L. McTeague, 1987, **E**, det. A. McG. Stirling. 1st native record from W. Scotland.

†211/5. RUBUS PARVIFLORUS Nutt. ***98**, Main Argyll: R. Add, Kilmichael Glassary, GR 16/86.94. Island in river. M. G. B. Hughes & B. H. Thompson, 1989, det. D. R. McKean.

†211/7. RUBUS PHOENICOLASIUS Maxim. ***5**, S. Somerset: Leighland Chapel, Old Cleeve, GR 31/03.36. Lane side. C. J. Giddens, 1988.

211/11/14. RUBUS CONJUNGENS (Bab.) Rogers ***4**, N. Devon: Braunton Burrows, GR 21/45.34. Dunes. B.S.B.I. Meeting, 1989, det. A. Newton.

211/11/27. RUBUS TUBERCULATUS Bab. ***4**, N. Devon: Croyde Bay, GR 21/43.39. Pathside. B.S.B.I. Meeting, 1989, det. A. Newton.

211/11/32. RUBUS BRITANNICUS Rogers ***4**, N. Devon: West Molland, GR 21/79.28. Forestry track. B.S.B.I. Meeting, 1989, det. A. Newton.

211/11/116. RUBUS ACCLIVITATUM W. C. R. Watson ***4**, N. Devon: Heasley Mill, GR 21/73.32. Rough field. B.S.B.I. Meeting, 1989, det. A. Newton.

211/11/123. RUBUS CARDIOPHYLLUS P. J. Mueller & Lefèvre ***75**, Ayrs.: Finnarts Bay, Loch Ryan, GR 25/05.72. A. McG. Stirling, 1972, **E**, det. A. Newton.

211/11/133. RUBUS ROSSENSIS Newton ***4**, N. Devon: Hares Down, GR 21/84.20. Moorland edge. B.S.B.I. Meeting, 1989, det. A. Newton.

211/11/183. RUBUS DREJERI G. Jensen ***75**, Ayrs.: Grassyards, Mauchline, GR 26/51.27. Planted shelter belt. A. Newton & A. McG. Stirling, 1987, **E**, det. A. Newton.

211/11/249. RUBUS MORGANWGENSIS W. C. Barton & Riddelsd. ***4**, N. Devon: Odam Moor, GR 21/74.18. Forestry plantation. B.S.B.I. Meeting, 1989, det. A. Newton.

211/11/380. RUBUS AEQUALIDENS Newton ***4**, N. Devon: Huntsham Wood, GR 31/00.18. Forestry entrance. L. J. Margetts, 1985, det. A. Newton.

211/11/bar. RUBUS BARTONII Newton ***4**, N. Devon: Hobby Drive, Clovelly, GR 21/33.23. Woodland. A. Newton, 1989.

211/11/lam. RUBUS LAMBURNENSIS Rilstone ***4**, N. Devon: Hockworthy, GR 31/02.19. Roadside. L. J. Margetts, 1988, det. A. Newton.

†212/8. POTENTILLA NORVEGICA L. **41**, Glam.: Mountain Ash, GR 31/0.9. Reclaimed land. J. P. Curtis *et al.*, 1987, **NMW**, det. R. G. Ellis. 2nd extant locality.

212/13. POTENTILLA ERECTA subsp. STRICTISSIMA (Zimm.) A. Richards ***H40**, Co. Londonderry: Grange Park Wood, GR 24/74.29. Grass heath over peat. D. S. Lambert, 1989, det. A. J. Richards.

212/14. POTENTILLA ANGLICA Laicharding **7**, N. Wilts.: Prickmoor Wood, GR 31/95.65. Pasture by wood. D. Green, 1987, det. B. Harold. Only extant locality. ***79**, Selkirks.: Wood Street, Galashiels, GR 36/47.37. J. A. Murray, 1982, **herb. R.W.M. Corner**, det. B. Harold.

220/3/2. ALCHEMILLA FILICAULIS subsp. VESTITA (Buser) M. E. Bradshaw ***46**, Cards.: Cwm Berwyn, GR 22/72.78. Sheep-grazed slope with boulders. A. O. Chater, 1988, **NMW**, det. S. M. Walters.

225/11. ROSA TOMENTOSA Sm. ***39**, Staffs.: Kinver Edge, GR 32/83.82. Border of conifer plantation. C. B. Westall, 1989. Rudyard Lake, GR 33/94.61. Disused railway. D. J. Tinston, 1989, **herb. B.R. Fowler**. 1st and 2nd records, both det. A. L. Primavesi.

225/13 × 11. ROSA MOLLIS Sm. × R. TOMENTOSA Sm. ***39**, Staffs.: Bateman's Dingle, Upper Arley, GR 32/77.80. Scrub on woodland edge. R. Maskew, 1989, det. A. L. Primavesi.

†225/mul. ROSA MULTIFLORA Thunb. ***39**, Staffs.: Planks Lane, Wombourne, GR 32/86.92. Road verge. C. B. Westall, 1988. Known here for 20 years.

226/†2 × 1. PRUNUS DOMESTICA L. × P. SPINOSA L. ***5**, S. Somerset: Muchelney Ham, GR 31/43.23. Hedge. P. & I. Green, 1978, det. A. C. Leslie.

†227/2. COTONEASTER SIMONSII Baker **77**, Lanarks.: Shiels, GR 26/52.66. Waste ground. P. Macpherson, 1985. 2nd record.

†227/3. COTONEASTER HORIZONTALIS Decne **77**, Lanarks.: Cambuslang, GR 26/65.60. Shrubby ground. P. Macpherson, 1986. 2nd record of established population. ***79**, Selkirks.: St Mary's Loch, GR 36/24.23. Rocky bank. R. W. M. Corner, 1989, **herb. R.W.M.C.**

†227/4. COTONEASTER MICROPHYLLUS Wallich ex Lindley **39**, Staffs.: Caldon Low, GR 43/08.48. Face of lime quarry. B. R. Fowler, 1988. 1st post-1930 record.

†227/bul. COTONEASTER BULLATUS Boiss. **77**, Lanarks.: Drumoyne, Glasgow, GR 26/54.64. Roadside. P. Macpherson, 1986, **herb. P.M.**, det. J. R. Palmer. 2nd record.

†227/die. COTONEASTER DIELSIANUS E. Pritzel ex Diels ***12**, N. Hants.: Wheatham Hill, GR 41/74.27. Chalky bank. J. D. Fryer, 1985, **herb. J.D.F.**, det. J. R. Palmer & C. A. Stace. ***77**, Lanarks.: Yorkhill, Glasgow, GR 26/55.65. Wood. P. Macpherson, 1985. Drumoyne, Glasgow,

GR 26/54.65. Roadside. P. Macpherson, 1986. Both **herb. P.M.**, det. J. R. Palmer. 1st and 2nd records.

†227/div. COTONEASTER DIVARICATUS Redh. & Wils. ***29**, Cambs.: Near Chrishall Grange, GR 52/43.43. Shelterbelt of *Pinus nigra*. D. E. Coombe, 1989, **CGE**. ***77**, Lanarks.: Meadowside, Glasgow, GR 26/55.66. Waste ground. P. Macpherson, 1986, **herb. P. M.**, det. J. R. Palmer.

†227/fra. COTONEASTER FRANCHETII Boiss. ***77**, Lanarks.: Hutchestontown, GR 26/59.64. Along old wall. P. Macpherson, 1986, **herb. P. M.**, det. J. R. Palmer.

†227/san. COTONEASTER SANGUINEUS Yii ***77**, Lanarks.: Cambuslang, GR 26/64.60. Shrubby waste ground. P. Macpherson, 1987, **herb. P.M.**, det. J. R. Palmer.

†227/wat. COTONEASTER × WATERERI Exell ***12**, N. Hants.: Ashford Hanger, Steep, GR 41/73.26. Clearing in chalk hanger. J. D. Fryer, 1985, **herb. J.D.F.**, det. J. R. Palmer & C. A. Stace. ***77**, Lanarks.: Bellahouston, GR 26/64.60. Old railway line. P. Macpherson, 1987, **herb. P.M.**, det. J. R. Palmer.

232/7. SORBUS TORMINALIS (L.) Crantz **47**, Monts.: R. Banwy near New Bridge, Meifod, GR 33/13.10. Steep, wooded river bank. P. M. Benoit & M. Wainwright, 1989, **NMW**. 1st post-1930 record.

†235/3. SEDUM SPURIUM Bieb. ***39**, Staffs.: Cellarhead, GR 33/96.47. Disused sand quarry. I. J. Hopkins, 1988.

†235/4. SEDUM DASYPHYLLUM L. **41**, Glam.: Rhoose, GR 31/0.6. Disused quarry. J. P. Curtis, 1989. Only extant locality.

237/1. CRASSULA TILLAEA Lester-Garland ***2**, E. Cornwall: Par, GR 20/08.53. Areas of sandy gravel in caravan site above beach. R. M. Belringer & T. E. Griffiths, 1988, det. Lady R. FitzGerald & R. J. Murphy.

†237/hel. CRASSULA HELMSII (T. Kirk) Cockayne **46**, Cards.: Plas Gogerddan, GR 22/63.83. Pond. A. Jones, 1989. 2nd record. ***47**, Monts.: Llangadfan, GR 33/02.13. Mud by man-made pool. M. Wainwright, 1989, det. F. H. Dawson. ***53**, S. Lincs.: Swanholme, GR 43/94.68. Old sand and gravel pit. T. Smith, 1985. ***54**, N. Lincs.: Double Drain, Hirst Priory, GR 44/77.09. Large drain. H. E. Stace, 1986.

†239/7. SAXIFRAGA CYMBALARIA L. **35**, Mons.: St Maughan's, GR 32/4.1. Garden weed. P. C. Hall, 1980. 2nd record.

239/8. SAXIFRAGA TRIDACTYLITES L. ***75**, Ayrs.: Nobel Works, Ardeer, GR 26/28.40. Sandy trackside. A. McG. Stirling, 1988, **GL**.

†240/1. TELLIMA GRANDIFLORA (Pursh) Douglas ex Lindley **80**, Roxburghs.: R. Tweed below Littledean Tower, GR 36/63.31. River bank. R. W. M. Corner, 1989, **herb. R.W.M.C.** 2nd record.

246/2. RIBES SPICATUM Robson **67**, S. Northumb.: R. East Allen near Wooley Scar, GR 35/83.54. River bank. G. A. & M. Swan, 1974, **herb. G.A.S.** 1st post-1930 record. ***68**, Cheviot: Denwick, GR 46/21.14. Disused limestone quarry. G. A. Swan & R. S. G. Thompson, 1974, **herb. G.A.S.** 1st native record, but probably now extinct here. North bank of R. Coquet, GR 46/09.00. River bank. G. A. Swan, 1989, **herb. G.A.S.** 2nd record.

251/1. DAPHNE MEZEREUM L. †***43**, Rads.: Dolyhir, GR 32/24.58. Old limestone quarry. I. D. Soane & R. G. Woods, 1989. **44**, Carms.: Coedydd Carmel S.S.S.I., GR 22/59.16. Limestone woodland. R. N. Stringer, 1989. 2nd record.

251/2. DAPHNE LAUREOLA L. †***43**, Rads.: Dolyhir, GR 32/24.58. Roadside verge. I. D. Soane & R. G. Woods, 1989. 2nd record.

254/7. EPILOBIUM TETRAGONUM L. subsp. TETRAGONUM ***67**, S. Northumb.: Near Anick, GR 35/95.65. Margin of pond. G. A. Swan, 1989, **herb. G.A.S.**, det. T. D. Pennington.

254/9 × 5. EPILOBIUM OBSCURUM Schreber × E. ROSEUM Schreber ***67**, S. Northumb.: Morpeth, GR 45/18.86. Garden weed. G. A. Swan, 1988, **herb. G.A.S.**, det. T. D. Pennington.

†256/2. OENOTHERA ERYTHROSEPALA Borbás ***80**, Roxburghs.: Allan Water, Galashiels, GR 36/51.36. Refuse tip. C. O. Badenoch, 1987, **E**, det. D. R. McKean.

†256/3. OENOTHERA STRICTA Ledeb. ex Link **38**, Warks.: Leamington Spa, GR 42/33.65. Allotment. J. W. Partridge, 1989, **WAR**, det. J. C. Bowra. 1st post-1930 record.

†256/fal. OENOTHERA FALLAX Renner ***25**, E. Suffolk: Cotton, GR 62/07.66. Roadside verge. R. Addington, 1989, det. J. C. Bowra.

258/1. CIRCAEA LUTETIANA L. **94**, Banffs.: Forglen, GR 38/69.52. Woodland. J. Edelsten, 1987, **E**, det. P. M. Benoit. 2nd record.

261/1. HIPPURIS VULGARIS L. **†45**, Pembs.: Blaencilgoed quarry, Ludchurch, GR 22/15.10. Flooded quarry. S. B. Evans & J. W. Donovan, 1989. 2nd record.

262/5. CALLITRICHE HERMAPHRODITICA L. ***53**, S. Lincs.: Teale's Pits, Whisby, GR 43/91.67. Old gravel pits. I. Weston, 1985, det. N. T. H. Holmes. Swanholme, GR 43/94.68. Old sand and gravel pits. H. Drewett & T. Smith, 1986. 1st and 2nd records.

262/6. CALLITRICHE TRUNCATA Guss. ***53**, S. Lincs.: Towthorpe Hollow Pond, Belton House, GR 43/92.38. Pond. K. Hearn, 1984.

277/2. TORILIS ARVENSIS (Hudson) Link **11**, S. Hants.: Upper Hamble Country Park, Botley, GR 41/50.11. Arable field. M. Southam, 1987. Only extant locality.

300/2. OENANTHE PIMPINELLOIDES L. **7**, N. Wilts.: Melksham Without, GR 31/93.62. Pasture. D. Green, 1988, **herb. D. G.** 2nd record.

†309/3. PEUCEDANUM OSTRUTHIUM (L.) Koch **79**, Selkirks.: Ettrick Water, Oakwood Mill Farm, GR 36/44.26. River bank. R. W. M. Corner, 1989, **herb. R.W.M.C.** 2nd extant locality.

311/†2 × 1. HERACLEUM MANTEGAZZIANUM Sommier & Levier × H. SPHONDYLIUM L. ***75**, Ayrs.: Maidenhead Bay, GR 26/21.08. Sandy ground. A. McG. Stirling, 1987. ***99**, Dunbarton: Kirkmichael, Helensburgh, GR 26/30.83. Waste ground near stream. A. Rutherford, 1989.

319/7. EUPHORBIA PLATYPHYLLOS L. **38**, Warks.: Walton, GR 42/29.52. Edge of field. H. A. Roberts, 1988, **WAR**, det. J. C. Bowra. 1st record since 1891.

319/8. EUPHORBIA SERRULATA Thuill. **†*5**, S. Somerset: Curry Rivel, GR 31/41.27. Disused railway line. P. Green, 1988, det. A. C. Leslie.

†319/15 × wal. EUPHORBIA ESULA L. × E. WALDSTEINII (Soják) A. Radcliffe-Smith ***39**, Staffs.: Coseley, GR 32/94.93. Waste ground. W. A. Thompson, 1987, **herb. B.R. Fowler**, det. A. Ratcliffe-Smith.

320/1/3. POLYGONUM RURIVAGUM Jordan ex Boreau **7**, N. Wilts.: Biddistone, GR 31/87.72. Arable field. D. Green, 1988. Only extant locality. ***46**, Cards.: Llwynysgaw, Felin-wynt, GR 22/21.52. Beanfield. A. O. Chater, 1989, **NMW**, det. J. R. Akeroyd. Dominant over c.4 acres. ***73**, Kirkcudbrights.: Southerness, GR 25/97.54. Sandy ground. O. M. Stewart, 1984, **E**, det. B. T. Styles.

320/1/bor. POLYGONUM BOREALE (Lange) Small ***103**, Mid Ebudes: Aird Mor, Balephetrish Bay, Tiree, GR 07/99.47. Upper, sandy beach. C. D. Preston & N. F. Stewart, 1989, **CGE**, det. J. R. Akeroyd.

†320/19 × 20. REYNOUTRIA JAPONICA Houtt. × R. SACHALINENSIS (Friedrich Schmidt Petrop.) Nakai ***11**, S. Hants.: Sarisbury, GR 41/50.07. Under trees by fence. R. M. Veall, 1988, **herb. R.P. Bowman**, det. J. P. Bailey

325/1/2. RUMEX ACETOSELLA subsp. ANGIOCARPUS Murb. **46**, Cards.: R.A.E. site, Aberporth, GR 22/24.52. Disturbed ground. J. R. Akeroyd, 1989. 2nd record.

325/8. RUMEX LONGIFOLIUS DC. **39**, Staffs.: 2 km S. of Onecote, GR 43/04.53. Roadside verge. I. W. Brown 1989, det. J. R. Akeroyd. 1st post-1930 record.

325/11 × 13. RUMEX CRISPUS L. × R. PULCHER L. ***12**, N. Hants.: Chilbolton Common, GR 41/39.40. J. Fryer, 1988, **herb. A. Brewis**, det. J. R. Akeroyd.

325/12 × 13. RUMEX OBTUSIFOLIUS L. × R. PULCHER L. ***12**, N. Hants.: Chilbolton Common, GR 41/39.40. J. Fryer, 1988, **herb. A. Brewis**, det. J. R. Akeroyd.

325/15 × 13. RUMEX CONGLOMERATUS Murray × R. PULCHER L. ***12**, N. Hants.: Chilbolton Common, GR 41/39.40. J. Fryer, 1988, **herb. A. Brewis**, det. J. R. Akeroyd.

325/15 × 17. RUMEX CONGLOMERATUS Murray × R. PALUSTRIS Sm. ***16**, W. Kent: Shorne Marshes, GR 51/69.74. Edge of grazing marsh dyke. A. C. Leslie, 1986, **MNE**, det. J. R. Akeroyd.

325/17. RUMEX PALUSTRIS L. †***39**, Staffs.: Old Town Hill, Rowley Regis, GR 32/95.86. Demolition site. B. Westwood, 1989, **herb. B.R. Fowler**, det. J. R. Akeroyd.

343/13 × 12. SALIX AURITA L. × S. CINEREA L. ***94**, Banffs.: Hillhead of Mountblairy, GR 38/68.52. Wet woodland. J. Edelsten, 1987, **E**, det. R. D. Meikle.

359/3b. PYROLA ROTUNDIFOLIA subsp. MARITIMA (Kenyon) E. F. Warburg ***50**, Denbs.: Minera, GR 33/26.51. Dense scrub over wet limestone quarry waste. G. Spencer, 1989, **NMW**, det. R. G. Ellis.

362/1. MONOTROPA HYPOPITYS L. **39**, Staffs.: Sandy Slade, GR 43/00.13. Pine plantation. J. Brough, 1989, **herb. B.R. Fowler**. 2nd post-1930 record.

372/4. ANAGALLIS MINIMA (L.) E. H. L. Krause ***H36**, Tyrone: Curran's Glen, GR 23/35.83. Damp, sandy ground near lake. I. McNeill, 1987, **BEL**.

382/1. CENTAURIUM PULCHELLUM (Swartz) Druce ***68**, Cheviot: Bamburgh Links, GR 46/19.34. Fixed sand dune. G. A. Swan, 1988. Budle, GR 46/16.36. Grassy flush near sea. G. A. Swan, 1989, both **herb. G.A.S.**, det. F. Ubsdell. 1st and 2nd confirmed records.

383/1. BLACKSTONIA PERFOLIATA (L.) Hudson †***67**, S. Northumb.: West Hartford Farm, GR 45/25.78. Central reservation of dual carriageway. H. Watson, 1987, **herb. G.A. Swan.** 1st confirmed record.

385/1. GENTIANELLA CAMPESTRIS (L.) Börner **12**, N. Hants.: Highclere Park, GR 41/45.60. Old herb-rich grassland. A. Byfield, 1986, det. F. Rose. 1st record for 75 years.

385/4. GENTIANELLA ANGLICA (Pugsley) E. F. Warburg ***5**, S. Somerset: West Hatch, GR 31/27.21. Limestone grassland. M. Davidson, 1989.

387/1. NYMPHOIDES PELTATA (S. G. Gmelin) O. Kuntze †***80**, Roxburghs.: Bowden Moor Reservoir, GR 36/54.31. Margin of reservoir. R. W. M. Corner, 1986, **herb. R.W.M.C.**

†PHACELIA TANACETIFOLIA Bentham ***12**, N. Hants.: Berry Head Farm, GR 41/77.28. Grass weed. F. Finucane, 1973, det. J. E. Lousley. Kingsley, GR 41/78.38. Abundant garden weed. A. Macey, 1982, still present in 1988, det. F. Rose. 1st and 2nd records.

392/1. SYMPHYTUM OFFICINALE L. ***79**, Selkirks.: S. side of R. Ettrick below Annelshope, GR 36/30.16. *Carex acuta* dominated fen. R. W. M. Corner, 1988, **herb. R.W.M.C.**, det. F. H. Perring.

392/6. SYMPHYTUM TUBEROSUM L. †***8**, S. Wilts.: Berwick St Leonard, GR 31/92.33. Roadside verge. Fonthill Bishop, GR 31/93.33. Shaded, damp waste ground. Both V. Hopkinson, 1987, det. A. M. Hutchison. 1st and 2nd records.

†392/7. SYMPHYTUM IBIRICUM Steven ***8**, S. Wilts.: West Ashton, GR 31/88.55. J. Swanborough, 1973. Fonthill Gifford, GR 31/93.31. Roadside verge. J. Hindley, 1987, det. A. M. Hutchison. 1st and 2nd records. **67**, S. Northumb.: Halton, GR 35/99.67. By churchyard wall. G. A. Swan, 1987, **herb. G.A.S.** 2nd record.

400/8 umb. MYOSOTIS ARVENSIS (L.) Hill subsp. UMBRATA (Rouy) O. Schwarz *67, S. Northumb.: Hag Wood near Whitley Chapel, GR 35/91.57. Edge of wood. G. A. & M. Swan, 1989. *68, Cheviot: Warkworth, GR 46/25.06. G. A. Swan, 1989. Hazely Hill, GR 36/95.40. Woodland. G. A. & M. Swan, 1989. 1st and 2nd records. All **herb. G.A.S.**, det. D. Welch.

400/10 glo. MYOSOTIS RAMOSISSIMA Rochel subsp. GLOBULARIS (Samp.) Grau *68, Cheviot: Ross Links, GR 46/13.39. Sand dune. G. A. Swan, 1989, **herb. G.A.S.**, det. D. Welch.

407/1. CUSCUTA EUROPAEA L. 12, N. Hants.: Ashford Hill, GR 41/56.62. Nettles on stream-bank. P. Brough, 1988. 1st record since 1928.

†409/1. LYCIUM BARBARUM L. *75, Ayrs.: Shalloch park, Girvan, GR 25/18.96. Roadside verge. A. Rutherford, 1989. Bennane Lea, GR 25/09.85. Sandy roadside near sea. A. McG. Stirling & A. Rutherford, 1989. 1st and 2nd records.

†409/2. LYCIUM CHINENSE Miller *12, N. Hants.: Shipton Bellinger, GR 41/23.44. Roadside hedge. R. P. Bowman, 1975, **herb. R.P.B.**, det. F. Rose. *77, Lanarks.: Westburn, GR 26/65.60. Hedge. P. Macpherson, 1989, **herb. P.M.**

†413/4. SOLANUM SARRACHOIDES Sendtner *7, N. Wilts.: Bromham, GR 31/96.64. Market gardens. D. Green & R. Randall, 1986.

416/7 × 1. VERBASCUM NIGRUM L. × V. THAPSUS L. *14, E. Sussex: Crawley, GR 51/28.37. Railway embankment. A. G. Hoare, 1989, det. I. K. Ferguson.

420/3 × 4. LINARIA REPENS (L.) Miller × L. VULGARIS Miller *99, Dunbarton: Bearsden Station, GR 26/54.71. Stony ground, with *L. repens*. A. McG. Stirling, 1989.

†425/3. MIMULUS MOSCHATUS Douglas ex Lindley *77, Lanarks.: Westburn near Glasgow, GR 26/65.60. Dug-out sandy area. P. & A. C. Macpherson, 1989, **herb. P.M.**

430/20 hed. VERONICA HEDERIFOLIA L. subsp. HEDERIFOLIA 80, Roxburghs.: St Boswell's, GR 36/58.30. Shaded earthy bank. R. W. M. Corner, 1989, **herb. R.W.M.C.** 2nd record. *99, Dunbarton: Overtoun, GR 26/41.75. Lane-side. A. McG. Stirling, 1985, **herb. A.McG.S.**

430/20 luc. VERONICA HEDERIFOLIA subsp. LUCORUM (Klett & Richter) Hartl *75, Ayrs.: Barassie, GR 26/32.33. Garden weed on sandy soil. A. McG. Stirling, 1989. *99, Dunbarton: Helensburgh, GR 26/30.82. Base of wall by path. A. McG. Stirling, 1989. Montrose Street, Helensburgh, GR 26/29.82. A. Rutherford, 1989, **herb. A. McG. Stirling**, det. A.McG.S. 1st and 2nd records.

430/22. VERONICA POLITA Fries 94, Banffs.: Portsoy, GR 38/58.65. Garden weed. J. Edelsten, 1987, **E**. 2nd record.

433/2 cal. RHINANTHUS MINOR L. subsp. CALCAREUS Wilmott 7, N. Wilts.: Aston Keynes, GR 41/0.9. Limestone gravel. D. Green, 1988, det. D. J. Hambler. 2nd extant locality.

435/1/1 × 13. EUPHRASIA MICRANTHA Reichenb. × E. NEMOROSA (Pers.) Wallr. *12, N. Hants.: Blackbushe, Yateley, GR 41/81.59. Heathland on old airfield. F. Rose & C. R. Hall, 1988, **herb. R.P. Bowman**, det. A. J. Silverside.

435/1/2. EUPHRASIA SCOTTICA Wettst. *35, Mons.: Twmbarlwn, GR 31/2.9. Wet grassland on mountain slopes. T. G. Evans, 1986, **herb. T.G.E.**, det. A. J. Silverside.

435/1/5. EUPHRASIA FOULAENSIS Townsend ex Wettst. *98, Main Argyll: Cullipool, Luing Island, GR 17/73.12. Grassland by sea. P. F. Yeo, 1988, **CGE**.

435/1/15. EUPHRASIA CONFUSA Pugsley *25, E. Suffolk: Between Sizewell and Thorpeness, GR 62/47.61. At top of beach, below heathland. E. M. Hyde, 1985, **IPS**, det. A. J. Silverside.

435/1/15 × 2. EUPHRASIA CONFUSA Pugsley × E. SCOTTICA Wettst. *77, Lanarks.: Carnwell, GR 36/0.4. Heath. P. Macpherson, 1988, **herb. P.M.**, det. A. J. Silverside.

435/1/17. EUPHRASIA ARCTICA subsp. BOREALIS (Townsend) Yeo *12, N. Hants.: Winnal Moors, Winchester, GR 41/48.30. Grass path along stream. R. P. Bowman, 1985. Bransbury

Common, GR 41/41.41. Damp, alluvial fen grassland. R. P. Bowman, 1988. Both **herb. R.P.B.**, det. A. J. Silverside. 1st and 2nd records.

435/1/17 × 13. EUPHRASIA ARCTICA subsp. BOREALIS (Townsend) Yeo × E. NEMOROSA (Pers.) Wallr. ***12**, N. Hants.: Bransbury Common, GR 41/41.41. Fen meadow. F. Rose, 1988, **herb. R.P. Bowman**, det. A. J. Silverside.

437/1. PARENTUCELLIA VISCOSA (L.) Caruel **8**, S. Wilts.: Scotchel Green, Pewsey, GR 41/16.60. Rough grassland. R. Dauntsey, 1988, det. A. M. Hutchison. 2nd record.

†439/2. LATHRAEA CLANDESTINA L. **4**, N. Devon: Stowford, GR 20/40.87. Extensive patches in wet woodland. J. Heath, 1989. 2nd record. ***35**, Mons.: Lydart, GR 32/50.09. Old green lane. S. Harper, 1987, **herb. T.G. Evans**. 1st Welsh record.

440/3. OROBANCHE RAPUM-GENISTAE Thuill. **12**, N. Hants.: Silchester Common, GR 41/62.62. P. Brough, 1987. 2nd record.

440/10. OROBANCHE HEDERAE Duby †***12**, N. Hants.: Alresford, GR 41/58.32. On *Hedera* under beech. A. A. Butcher, 1989, det. F. J. Rumsey as forma *monochroma* G. Beck.

455/4. SALVIA VERBENACA L. **52**, Anglesey: Penmon Priory, GR 23/62.80. Limestone outcrop. M. R. Davies, 1989, det. R. H. Roberts. 1st post-1930 record.

459/3. STACHYS ARVENSIS (L.) L. **7**, N. Wilts.: Sandy Lane, GR 31/96.67. Arable land. D. Green, 1985. 2nd extant locality.

†461/1 arg. LAMIASTRUM GALEOBDOLON subsp. ARGENTATUM (Smejkal) Stace ***67**, S. Northumb.: Near Ponteland, GR 45/15.73. Edge of small wood. G. A. & M. Swan, 1976, **herb. G.A.S.** Hart Burn near Rothley Lodge, GR 45/04.87. Shady bank. G. A. & M. Swan, 1984. 1st and 2nd records. ***79**, Selkirks.: Island at confluence of Ettrick and Yarrow Waters, GR 36/44.27. Riverbank. D. J. Methven, 1988, **herb. R.W.M. Corner**, det. A. McG. Stirling. 1st localised record.

462/3. LAMIUM HYBRIDUM Vill. **11**, S. Hants.: Gardners Lane, Romsey, GR 41/33.19. Winter wheat. P. J. Wilson, 1987. Only extant locality.

472/1 int. PLANTAGO MAJOR subsp. INTERMEDIA (DC.) Arcangeli ***67**, S. Northumb.: Morpeth, GR 45/18.86. Garden weed on clay soil. G. A. Swan, 1988. ***68**, Cheviot: Near Whiteadder Water, GR 36/95.52. Waste ground. G. A. Swan, 1989. Both **herb. G.A.S.**, det. J. R. Akeroyd.

475/2. CAMPANULA TRACHELIUM L. †**73**, Kirkcudbrights.: South-west of Laudlaugh Bridge, GR 25/79.71. Roadside ditch. O. M. Stewart, 1989, **E**. 1st post-1930 record.

†475/4. CAMPANULA LACTIFLORA Bieb. ***79**, Selkirks.: Sunderland Hall, GR 36/48.31. Steep bank above river. R. W. M. Corner, 1986, **E**, det. D. R. McKean.

475/8. CAMPANULA PATULA L. **39**, Staffs.: Upper Arley, GR 32/75.80. Grazed woodland. M. Smith, 1987. 1st post-1930 record.

479/1. JASIONE MONTANA L. **38**, Warks.: Middleton, GR 42/19.98. Waste ground. M. J. Senior, 1989, **WAR**, det. J. C. Bowra. 1st record since 1874 record in this area. **53**, S. Lincs.: Doddington Road, Lincoln, GR 43/94.67. Waste ground. V. Pennell, 1984. 2nd record.

485/3. GALIUM MOLLUGO L. ***79**, Selkirks.: S. side of Gala Water, Galashiels, GR 36/47.37. Old railway track. J. A. Murray, 1986, **herb. R.W.M. Corner**.

485/9. GALIUM DEBILE Desv. ***8**, S. Wilts.: North Charlton water meadows, GR 41/17.24. Margin of drainage ditch. N. L. Chadwick, 1984, det. J. Ounsted. Teffont, GR 31/99.31. Dry pond. V. Hopkinson, 1988, det. A. M. Hutchison. 1st and 2nd records.

†489/1. SYMPHORICARPOS ALBUS (L.). S. F. Blake var. LAEVIGATUS (Fernald) S. F. Blake ***99**, Dunbarton: Helensburgh, GR 26/30.82. Woods. A. Rutherford, c. 1979. 1st record of species.

†491/1. LONICERA XYLOSTEUM L. **50**, Denbs.: Loggerheads near Mold, GR 33/19.62. B.Ing, 1988. 2nd record.

†491/4. LONICERA CAPRIFOLIUM L. ***79**, Selkirks.: Philiphaugh, Yarrow, GR 36/44.27. Woodland. A. J. Smith, 1988, **herb. R.W.M. Corner**.

[†491/cae. LONICERA CAERULEA L. **57**, Derbys.: Delete record published in *Watsonia* **16**: 192 (1986), plant is *L. involucrata* (Richardson) Banks ex Sprengel, det. C. A. Stace, and is not naturalized.]

494/2. VALERIANELLA CARINATA Loisel. **7**, N. Wilts.: Cotswold Water Park, GR 41/01.94. Dumped soil. S. C. Holland, 1988. Only extant locality.

497/2. DIPSACUS PILOSUS L. **41**, Glam.: East Aberthaw, GR 31/0.6. Streamside. J. P. Curtis, 1987. 2nd record.

506/2 × 1. SENECIO AQUATICUS Hill × S. JACOBAEA L. ***38**, Warks.: Hampton Lucy, GR 42/25.55. Churchyard. J. W. Partridge, 1988, **WAR**, det. C. Jeffrey.

†506/9. SENECIO TANGUTICUS Maxim. ***76**, Renfrews.: Cowglen, Glasgow, GR 26/54.60. Roadside. E. L. S. Lindsay & A. C. Macpherson, 1981, **herb. P. Macpherson**, det. M. McC. Webster. Still present.

†506/13. SENECIO FLUVIATILIS Wallr. **67**, S. Northumb.: Elson Burn, GR 35/93.92. Streambank. G. A. & M. Swan, 1989, **herb. G.A.S.** 2nd record, 1st this century.

†509/4. PETASITES FRAGRANS (Vill.) C. Presl **77**, Lanarks.: Thorntonhall, GR 26/59.55. Path through wood. P. Macpherson, 1989. 2nd record.

†518/3. SOLIDAGO GIGANTEA Aiton ***26**, W. Suffolk: Elmswell, GR 62/00.66. Open glade in wood. R. Addington, 1989, det. E. M. Hyde. ***39**, Staffs.: Weston Sprink, GR 33/93.43. Scrub in old pasture. Berry Hill, GR 33/90.46. Waste ground. Both I. J. Hopkins, 1988. 1st and 2nd records.

†519/7 × 6. ASTER LAEVIS L. × A. NOVI-BELGII L. ***39**, Staffs.: Wombourne, GR 32/87.92. Roadside verge. C. B. Westall, 1987, det. P. F. Yeo.

526/3. ANTHEMIS ARVENSIS L. **33**, E. Gloucs.: Aldsworth, GR 42/18.11. Edge of arable field. R. J. Cooper & S. C. Holland, 1989. Only extant locality.

†534/1. COTULA CORONOPIFOLIA L. ***39**, Staffs.: Drummond Road, Stafford, GR 33/92.24. Slightly saline marsh. R. Hill, 1989, **herb. B.R. Fowler**.

539/3. CARDUUS NUTANS L. †***103**, Mid Ebudes: West of A' Chroic, Coll, GR 17/22.62. Roadside by sea. C. D. Preston & N. F. Stewart, 1989.

558/1/94. HIERACIUM DURICEPS F. J. Hanb. ***93**, N. Aberdeen: Cabrach, GR 38/36.21. Rock ledge. D. Welch, 1987, **herb. D. W.**, det. P. D. Sell.

558/1/193. HIERACIUM PLACEROPHYLLOIDES Pugsley ***73**, Kirkcudbrights.: Kirkpatrick Durham, GR 25/76.76. Grassy laneside bank. J. Bevan, 1986, **herb. J.B.**

558/1/196. HIERACIUM SPARSIFOLIUM Lindeb. ***75**, Ayrs.: Stinchar Bridge, Straiton, GR 26/39.95. Rocks in stream. A. McG. Stirling, 1989.

558/1/210. HIERACIUM STRICTIFORME (Zahn) Roffey ***93**, N. Aberdeen: Cabrach, GR 38/38.26. Rock ledge in gorge. D. Welch, 1988, **ABD**, det. P. D. Sell.

558/1/211. HIERACIUM RETICULATUM (Lindeb.) Lindeb. ***93**, N. Aberdeen: Ravenscraig, GR 48/09.48. Walls of ruined castle. D. Welch, 1988, **ABD**, det. P. D. Sell.

558/1/221. HIERACIUM RIGENS Jordan ***35**, Mons.: Slade Wood, Rogiet, GR 31/45.89. Pathside in wood. T. G. Evans, 1986, **herb. T.G.E.**, det. J. Bevan.

558/1/222. HIERACIUM SALTICOLA (Sudre) Sell & C. West †***35**, Mons.: Newport Docks, GR 31/31.86. Rail ballast. T. G. Evans, 1980, **herb. T.G.E.**, det. J. Bevan.

558/2/1 eur. PILOSELLA OFFICINARUM subsp. EURONOTA (Naegeli & Peter) Sell & C. West *75, Ayrs.: Muck Water, Dalmellington, GR 26/48.05. Stream bank. A. McG. Stirling, 1989, **herb. A.McG.S.**

558/2/1 off. PILOSELLA OFFICINARUM F. W. Schultz & Schultz Bip. subsp. OFFICINARUM *75, Ayrs.: Muck Water, Dalmellington, GR 26/48.05. Stream bank. A. McG. Stirling, 1989, **herb. A.McG.S.**

559/5. CREPIS BIENNIS L. †2, E. Cornwall: Stratton, GR 21/22.06. Grassy bank by road. L. J. Margetts, 1989, **herb. L.J.M.** 1st post-1930 record.

561/1. BALDELLIA RANUNCULOIDES (L.) Parl. **21**, Middlesex: Glebelands Wood, East Finchley, GR 51/26.91. Edge of shallow pond. D. Bevan, 1988, **herb. D.B.** Only extant locality.

567/1. HYDROCHARIS MORSUS-RANAE L. **67**, S. Northumb.: Near Healey Wood, GR 45/23.83. Pond. N. Scott, 1986, **herb. G.A. Swan.** 2nd record, 1st this century.

†570/3. ELODEA NUTTALLII (Planchon) St. John **26**, W. Suffolk: Great Ashfield, GR 62/00.67. Pond. R. Addington, 1989, det. M. N. Sanford. 2nd record *46, Cards.: Rhos Pil-bach, Plwmp, GR 22/36.56. Pond in pasture. Afon Aeron 1 km E. of Talsarn, GR 22/55.56. River. Both A. O. Chater, 1989, **NMW**, det. D. A. Simpson. 1st and 2nd records. **67**, S. Northumb.: Queen Elizabeth Country Park, GR 45/28.89. Artificial lake. G. A. Swan, 1989, **herb. G.A.S.**, det. D. A. Simpson. 2nd record. *H36, Tyrone: Lough Neagh S. of Stanniards Point, GR 23/96.77. Lough Neagh, Ardboe Point, GR 23/96.76. Both D. A. Simpson & J. A. N. Parnell, 1984. 1st and 2nd records.

577/6. POTAMOGETON GRAMINEUS L. **68**, Cheviot: Nelly's Moss Lakes, GR 46/08.02. G. A. Swan, 1989. 2nd record.

577/7 × 8. POTAMOGETON ALPINUS Balbis × P. PRAELONGUS Wulfen *H35, W. Donegal: Lough between Lough Goragh and Carryblagh, GR 24/23.42. C. D. Preston & N. F. Stewart, 1989, **CGE**. 1st Irish record.

577/11. POTAMOGETON FRIESII Rupr. **7**, N. Wilts.: Kennet and Avon Canal, Allington, GR 41/07.62. J. Lovell, 1987, det. D. Green. 2nd extant locality. *H35, W. Donegal: Melmore Lough, GR 24/12.43. Coastal lake. C. D. Preston *et al.*, 1989, **CGE**.

577/12. POTAMOGETON RUTILUS Wolfg. **103**, Mid Ebudes: Loch Ballyhaugh, Coll, GR 17/17.58. Machair loch. C. D. Preston & N. F. Stewart, 1989, **CGE**. 1st Coll and 2nd vice-county record. *108, W. Sutherland: Loch Awe, GR 29/24.15. E. Charter, 1988, **NCCE**, det. N. T. H. Holmes & C. D. Preston.

577/16. POTAMOGETON TRICHOIDES Cham. & Schlecht. **2**, E. Cornwall: Bude Canal, Bude, GR 21/21.04. Canal. C. D. Preston & N. F. Stewart, 1989, **CGE**. Only extant locality. **54**, N. Lincs.: Snakeholme Drain, Bardney, GR 53/10.71. T. C. G. Rich & I. Weston, 1987, **CGE**, det. C. D. Preston. Barton and Barrow Clay Pits, GR 54/03.22. Disused clay pit. C. D. Preston, H. E. Stace & N. F. Stewart, 1987, **CGE**. 1st and 2nd post-1930 records.

577/19 × 9. POTAMOGETON CRISPUS L. × P. PERFOLIATUS L. *73, Kirkcudbrights.: Carlingwark Loch, GR 25/76.61. Shallow water near edge of loch. C. D. Preston & O. M. Stewart, 1989, **CGE**.

577/19 × 11. POTAMOGETON CRISPUS L. × P. FRIESII Rupr. *73, Kirkcudbrights.: Carlingwark Loch, GR 25/76.61. Shallow water near edge of loch. O. M. Stewart, 1989, **E**, det. C. D. Preston. 1st Scottish record.

577/20. POTAMOGETON FILIFORMIS Pers. **80**, Roxburghs.: Lady Moss, GR 36/52.30. Pond. R. W. M. Corner, 1989, **CGE**, det. C. D. Preston. 2nd record.

581/1. NAJAS FLEXILIS (Willd.) Rostk. & W. L. E. Schmidt *97, Westerness: Loch a' Bhada Dharaich, GR 17/69.94. Water 1m deep. A. E. Newton & A. J. Shine, 1977, **CGE**, det. A. C. Jermy. **103**, Mid Ebudes: Loch an t-Sagairt, Coll, GR 17/25.60. C. D. Preston & N. F. Stewart, 1989, **CGE**. 2nd Coll record.

591/1b. ASPARAGUS OFFICINALIS subsp. PROSTRATUS (Dumort.) Corb. *2, E. Cornwall: Rocky Valley near Tintagel, GR 20/07.89. Steep, rocky slope. R. E. N. & C. J. Smith, 1988, det. L. J. Margetts.

†593/1. LILIUM MARTAGON L. *99, Dunbarton: Near Bearsden Station, GR 26/54.71. Wooded waste ground. A.McG. Stirling *et al.*, 1989.

600/†2 × 1. HYACINTHOIDES HISPANICA (Miller) Rothm. × H. NON-SCRIPTA (L.) Chouard ex Rothm. *39, Staffs.: Malthouse Lane, Caverswall, GR 33/94.45. Roadside verge. I. J. Hopkins, 1987.

†605/2. JUNCUS TENUIS Willd. *7, N. Wilts.: Winsley, GR 31/80.61. Roadside. J. Presland, 1987, **herb. D. Green.**

605/4. JUNCUS COMPRESSUS Jacq. **5**, S. Somerset: Durleigh Reservoir, GR 31/26.36. Barer areas just above high-water mark. P. Green, 1989. 2nd extant locality. **39**, Staffs.: Drummond Road, Stafford, GR 33/92.24. Marsh. R. Hill, 1989, **herb. B.R. Fowler**. 1st post-1930 record.

605/amb. JUNCUS AMBIGUUS Guss. ***108**, W. Sutherland: Clachtoll, GR 29/04.27. Damp, sandy ground at head of beach. Badnabay, GR 29/22.46. Muddy track leading to salt marsh. Both E. Norman, 1988, det. T. A. Cope. 1st and 2nd records.

†607/7. ALLIUM CARINATUM L. *77, Lanarks.: Bothwell, GR 26/69.58. Bank of R. Clyde. J. R. S. Lyth, 1989, **GL**.

607/8. ALLIUM SCHOENOPRASUM L. †*77, Lanarks.: Meadowside, Glasgow, GR 26/55.66. Roadside. P. Macpherson, 1989, **herb. P.M.** †*80, Roxburghs.: Rule Water below Bedrule, GR 36/59.17. Rocky edge of river. R. W. M. Corner, 1989.

†607/nig. ALLIUM NIGRUM L. *5, S. Somerset: Staple Plain, West Quantoxhead, GR 31/11.41. Rough pasture. C. J. Giddens, 1989, det. A. L. Grenfell.

†616/1. IRIS SPURIA L. *6, N. Somerset: Sand Point, GR 31/32.66. Limestone scrub. A. L. Grenfell, c.1950. Still present in 1988.

†616/sib. IRIS SIBIRICA L. *83, Midlothian: Musselburgh, Inveresk, GR 36/35.71. Rough grass by railway. D. R. McKean, 1988, **E**.

625/4. EPIPACTIS LEPTOCHILA (Godfrey) Godfrey **8**, S. Wilts.: Hound Wood, Winterslow, GR 41/22.30. Edge of wood. M. N. Jenkinson, 1984, det. R. P. Bowman. 2nd record.

625/6. EPIPACTIS PHYLLANTHES G. E. Sm. *6, N. Somerset: Leigh Woods, GR 31/55.74. Woodland by towpath. P. & I. Green, 1988, det. A. J. Richards.

635/1. COELOGLOSSUM VIRIDE (L.) Hartman **79**, Selkirks.: Selkirk Golf Course, GR 36/48.28. Grassland. M. J. Roger, 1986. 1st record since 1883.

643/1 × 3a. DACTYLORHIZA FUCHSII (Druce) Soó × D. INCARNATA (L.) Soó subsp. INCARNATA *64, Mid-W. Yorks.: Upper Wharfedale, GR 34/97.67. Wet, basic grassland. F. Horsman, 1989.

643/1 × 3b. DACTYLORHIZA FUCHSII (Druce) Soó × D. INCARNATA subsp. PULCHELLA (Druce) Soó *64, Mid-W. Yorks.: Upper Wharfedale, GR 34/97.67. Wet, basic grassland. F. Horsman, 1989.

643/3b × 4. DACTYLORHIZA INCARNATA subsp. PULCHELLA (Druce) Soó × D. PRAETERMISSA (Druce) Soó *46, Cards.: Ynys-las dunes, GR 22/60.93. Dune slack. F. Horsman, 1989.

643/3b × 6cam. DACTYLORHIZA INCARNATA subsp. PULCHELLA (Druce) Soó × D. MAJALIS subsp. CAMBRENSIS (R. H. Roberts) R. H. Roberts *46, Cards.: Ynys-las dunes, GR 22/60.93. Dune slack. F. Horsman, 1989.

643/5. DACTYLORHIZA PURPURELLA (T. & T. A. Stephenson) Soó *43, Rads.: Lane Farm, Rhosgoch, GR 32/18.46. Marshy field. H. L. J. Drewett, 1989. 2nd record.

SERAPIAS PARVIFLORA Parl. *2, E. Cornwall: Locality withheld. P. Cobbing, 1989. See *BSBI News* no. 52, p. 11 (1989). 1st British record.

†646/1. ACORUS CALAMUS L. *8, S. Wilts.: Kennet & Avon Canal, Devizes, GR 31/98.61. Canal bank. D. Green, 1986.

†647/1. CALLA PALUSTRIS L. *39, Staffs.: Stockwell Heath, GR 43/05.21. Shallow village pond. B. R. Fowler, 1988.

650/2. LEMNA TRISULCA L. 73, Kirkcudbrights.: Lochrutton Loch, GR 25/89.72. C. D. Preston & O. M. Stewart, 1989, **CGE**. 2nd record.

†650/min. LEMNA MINUSCULA Herter *38, Warks.: Solihull, GR 42/16.81. Pond. J. W. Partridge, 1989, **WAR**, det. A. C. Leslie.

654/3. ERIOPHORUM LATIFOLIUM Hoppe 44, Carms.: Cae Maesyffynnon near Port Aber, GR 22/77.20. Wet, flushed grassland. I. K. Morgan, 1989. 2nd record, 1st since 1908 record in this area. 50, Denbs.: Near Graianrhyd, GR 33/20.54. Marsh. J. A. Green, 1989, **NMW**. 2nd record.

657/2. BLYSMUS RUFUS (Hudson) Link *44, Carms.: Ffos Fach Marsh, Bynea, GR 21/55.99. Top of saltmarsh. N. C. C. Field Survey Team, 1988.

658/1. CYPERUS LONGUS L. †25, E. Suffolk: The Grove, Felixstowe, GR 62/30.35. Edge of pond. B. Matthews, 1989, det. M. N. Sanford. 2nd record.

663/10. CAREX VIRIDULA Michx subsp. VIRIDULA *39, Staffs.: Chasewater Reservoir, GR 43/03.08. Margin of reservoir. J. P. Martin, 1988, **herb. B.R. Fowler**, det. A. O. Chater.

663/16 × 17. CAREX ROSTRATA Stokes × C. VESICARIA L. *46, Cards.: Dolaugwyrddon-isaf, Lampeter, GR 22/55.46. Recently created artificial pond. A. O. Chater, 1989, **NMW**, det. A. O. C., R. W. David & A. C. Jermy.

663/22. CAREX PENDULA Hudson †80, Roxburghs.: Ettrick Water above Lindean Mill, GR 36/47.31. Open conifer plantation near river. E. Middleton, 1988, **herb. R.W.M. Corner.** 2nd record.

663/25. CAREX TOMENTOSA L. 7, N. Wilts.: South of Pike Corner, Minety, GR 41/03.92. Ridge and furrow pasture. L. Wild, 1988, **herb. D. Green**, det. R. W. David. 2nd extant locality.

663/28. CAREX LIMOSA L. *50, Denbs.: Hiraethog Moor, GR 23/93.55. Soligenous flush. P. Day, 1989, **NMW**, det. A. O. Chater. 81, Berwicks.: Brotherstone Hill, GR 36/61.35. Peat bog. R. W. M. Corner, 1989. 1st post-1930 record.

663/47 × 46. CAREX ACUTA L. × C. ELATA All. *6, N. Somerset: Axbridge, GR 31/43.53. Ditch. D. Pearman, 1983, **herb. D.P.**, det. A. O. Chater & A. C. Jermy.

[663/55. CAREX APPROPINQUATA Schumacher 45, Pembs.: Delete records, which are misidentifications of *C. diandra* Schrank, cf *BSBI News* no. 53, pp. 17–18, 1989.]

663/69. CAREX ELONGATA L. *47, Monts.: Llangyniew, GR 33/12.09. *Salix* swamp. W. Metcalfe & M. Wainwright, 1989, **NMW**, det. A. O. Chater & R. W. David.

663/72 × 54. CAREX CURTA Good. × C. PANICULATA L. *45, Pembs.: Dowrog Common, GR 12/77.26. R. W. David & S. B. Evans, 1989, **NMW**, det. A. O. Chater & R.W.D. 2nd Welsh and 3rd British record.

667/1 alt. MOLINIA CAERULEA (L.) Moench subsp. ALTISSIMA (Link) Domin 35, Mons.: Llangedfedd Reservoir, GR 31/3.9. Wet heath. T. G. Evans, 1987, **herb. T.G.E.** 2nd record.

669/2. GLYCERIA PLICATA (Fries) Fries 2, E. Cornwall: Kingsmill Lake, Landulph, GR 20/43.61. Marsh. R. W. Gould, 1989, **herb. R.J. Murphy**, det. L. J. Margetts & R. J. M. 1st post-1930 record.

670/6b. FESTUCA NIGRESCENS Lam. *77, Lanarks.: Between Glasgow and Renfrew, GR 26/51.67. Bare, grassy bank. P. Macpherson, 1986, **herb. P.M.**, det. P. J. O. Trist.

670/9. FESTUCA FILIFORMIS Pourret ***75**, Ayrs.: Upper Noddesdale, GR 26/26.68. Dry heathy ground. A.McG. Stirling, 1989, **herb. A. McG. S.**

670/12. FESTUCA GUESTFALICA Boenn. ex Reichenb. **54**, N. Lincs.: Seacroft Golf Course, Skegness, GR 53/56.60. I. Weston, 1982, det. P. J. O. Trist. 2nd record.

674/1. DESMAZERIA RIGIDA (L.) Tutin **47**, Monts.: Big Forest, Maesmawr, GR 33/15.10. Forest road. M. Wainwright, 1989, det. P. M. Benoit. 2nd record.

677/1. CATABROSA AQUATICA (L.) Beauv. ***76**, Renfrews.: Lunderston Bay, GR 26/20.73. Streamside on sandy shore. A. McG. Stirling, 1989. **80**, Roxburghs.: Primside Bog, GR 36/80.26. Fen and ditch. R. W. M. Corner, 1989, **herb. R.W.M.C.** 2nd extant locality.

681/2. MELICA NUTANS L. **43**, Rads.: North of Llanbadarn Fynydd, GR 32/08.79. Wooded roadside bank. R. G. Woods, 1989. 2nd record.

†683/4. BROMUS INERMIS Leysser ***5**, S. Somerset: Williton, GR 31/08.41. Grassy road bank. Lady R. FitzGerald, 1989.

683/5. BROMUS STERILIS L. **†93**, N. Aberdeen: St Combs, GR 48/04.63. Set-aside field. D. Welch, 1989. 2nd extant locality.

683/8. BROMUS ARVENSIS L. **33**, E. Gloucs.: Southfields Farm, Hardwicke, GR 32/77.10. Set-aside arable field. S. C. Holland & P. Wilson, 1989, **herb. S.C.H.**, det. D. M. Barling. Only extant locality.

†683/19. BROMUS CARINATUS Hooker & Arnott ***5**, S. Somerset: Henstridge, GR 31/72.21. Green lane. I. Green, 1989. ***12**, N. Hants.: Greywell, GR 41/71.51. C. Hora, 1986, **RNG**. Near King John's Castle, GR 41/72.51. Edge of Basingstoke Canal. C. Hora, 1989, **herb. Lady A. Brewis**, det. A. B. 1st and 2nd records.

†687/jub. HORDEUM JUBATUM L. **72**, Dumfriess.: A701 road, Moffat, GR 36/04.13. Roadside verge. H. J. Noltie & A. G. Miller, 1988. 2nd record.

688/1. HORDELYMUS EUROPAEUS (L.) C. O. Harz **53**, S. Lincs.: Skellingthorpe Wood, GR 43/90.72. Ancient wood. F. Aungier, 1981. 2nd extant locality.

694/1 bul. ARRHENATHERUM ELATIUS subsp. BULBOSUM (Willd.) Schübler & Martens ***67**, S. Northumb.: Coalburn Farm, GR 45/20.83. Edge of cultivated field. G. A. Swan, 1989. 1st localized record. ***68**, Cheviot: Near Red Burn, GR 46/15.20. Cultivated field. G. A. Swan, 1989. 1st localized record.

†697/3. AIRA CARYOPHYLLEA subsp. MULTICULMIS (Dumort.) Bonnier & Layens ***67**, S. Northumb.: Near Deadwater, GR 35/61.95. Forest track. G. A. & M. Swan, 1989, **herb. G.A.S.**, det. O. M. Stewart. ***68**, Cheviot: Near Woodbridge, GR 36/95.33. Sandy gravel near roadside. Thrunton Forest, GR 46/07.08. Side of forest road. Both G. A. & M. Swan, 1989, **herb. G.A.S.** 1st and 2nd records.

701/2b. AGROSTIS VINEALIS Schreber ***43**, Rads.: Harley Dingle, GR 32/18.64. Damp, shaded locality. R. G. Woods, 1989.

702/1. APERA SPICA-VENTI (L.) Beauv. **†7**, N. Wilts.: Biddestone, GR 31/87.73. Cornfield. D. Green, 1988. 2nd record. **†8**, S. Wilts.: Grovely Wood, GR 31/06.33. Margin of barley field. D. Simpson-Green, 1984, det. P. J. O. Trist. Fiddington Sands, GR 41/01.54. Edge of arable field. R. Fussell, 1984, det. A. Hutchison. 1st and 2nd records.

708/3 × 2. ALOPECURUS GENICULATUS L. × A. PRATENSIS L. ***14**, E. Sussex: Southease, GR 51/42.04. Tidal river meadows. E. Norman, 1985, det. P. J. O. Trist. ***29**, Cambs.: R. Granta, Linton, GR 52/56.46. River bank. P. J. O. Trist, 1982, **herb. P.J.O.T.**

709/1. MILIUM EFFUSUM L. **81**, Berwicks.: North Cleugh, Penmanshiel Wood, GR 36/79.68. Oakwood. M. E. Braithwaite, 1989, **herb. M.E.B.** 1st post-1930 record.

†720/1. SETARIA ITALICA (L.) Beauv. ***39**, Staffs.: Knypersley Reservoir, GR 33/89.54. Amongst sandstone blocks. I. W. Brown, 1989, det. T. A. Cope.

Book Reviews

Flore de la Suisse et des territoires limitrophes. D. Aeschimann & H. M. Burdet. Pp. liv + 597, with 17 pp. of figures. Editions du Griffon, Neuchâtel. 1989. Price SF48 (ISBN 2–88006–503–7).

The appearance of an entirely new Swiss flora is a rare but welcome event. With the subheading "le nouveau Binz", the title of this pocket flora pays homage to A. Binz's *School and Excursion flora* of 1920, a French translation of which first appeared in 1941. Three later editions of this work appeared, the most recent in 1976. A *Pocket Atlas of the Swiss flora* by Thommen, Becherer & Antonietti was published in 1983, but the new *Flore de la Suisse* is the first entirely new flora to appear since Hess, Landolt & Hirzel's *Flora der Schweiz* of 1967–72.

Dichotomous keys to families, genera and species are provided but there are no familial or generic descriptions. Limited synonymy is provided at the level of species and subspecies, but without literature citations. French vernacular names are given for genera, and translations of specific epithets are provided. For each species, longevity (categories are annual, biennial, perennial, shrub and tree), life-form (Raunkiær's categories are used together with 'lianes') and height are stated, followed by a very brief descriptive text which omits characters used in the keys. Phenology (taking account of altitude, which rather blurs the picture) and ecology (altitudinal zone, habitat category and substrate) are followed by a summary of the plant's distribution, frequency and status within the area covered by the flora. This includes not only the whole of Switzerland but also the adjacent areas of Savoy, the entire Jura massif, southernmost Germany, Vorarlberg and westernmost Tirol together with the alpine portions of N. Italy. A four-figure number provides a cross-reference to Thommen *et al.*'s Pocket Atlas illustrations. Subspecies are described, and hybrids listed, in small type.

Considerable progress has been made in clarifying the taxonomic treatment of the Swiss and alpine floras in recent decades. The authors state in the introduction that they have followed the nomenclature of Greuter *et al.*'s *Med Checklist* for the parts so far published, together with *Flora Europaea* and certain recent parts of Hegi which deal with the Asteraceae. This is a workable compromise which users of this flora will find easy to follow. The only other flora which has appeared post-*Flora Europaea* and covers part of its area is Pignatti's *Flora d'Italia*, whose lack of portability rivals that of Hess *et al.*

The book has been given a robust plastic binding, and the use of millimetre-ruled graph paper for the end papers is a thoughtful feature which should be widely copied by publishers of pocket floras. Although one must refer to other works for whole-plant illustrations, the 343 line drawings form a useful crib for features mentioned in the keys which would otherwise require lengthy descriptions, such as the appendices of the involucral bracts of species of *Centaurea*. For users like myself whose knowledge of French descriptive terminology is limited, there is a very useful glossary; this makes frequent reference to the figures and contains a few un-numbered illustrations of leaf shapes, inflorescence categories and a diagram showing the parts of an orchid flower.

Being able to reach a much wider readership than the 'heavyweight' floras of the region, this admirable excursion flora upholds the tradition of quality which one associates with the publications of the *Conservatoire et Jardin botaniques* of the City of Geneva, under whose auspices it appears, and it will give much pleasure to its users.

J. R. Edmondson

Vegetation of the Soviet polar deserts. V. D. Aleksandrova. Pp. xii + 228. Translated by D. Löve. Studies in Polar Research; Cambridge University Press. 1988. Price £30 (ISBN 0–521–32998–1).

The living tundra. Y. I. Chernov. Pp. xiv + 213. Translated by D. Löve. Studies in Polar Research; Cambridge University Press. 1985, paperback edition 1988. Price (paperback) £12·95 (ISBN 0–521–35754–3).

Aleksandrova's account deals with the most northerly part of the Russian Arctic, where the mean temperature of the warmest month fails to exceed 2°C. It covers the western and relatively oceanic Zemlya Frantsa-Josifa archipelago and the northern part of Novaya Zemlya and the more eastern and continental Severnaya Zemlya archipelago.

Polar deserts are characterised by a very sparse vegetation, often intimately related to patterned ground. The dominant plants are lichens and, to a lesser extent, mosses. The 90 or so species of flowering plants mentioned by the author play a very subordinate role. By comparison with the tundra zone to the south, sedges and gamopetalous species are few and regional differentiation of the flora is weak.

This is essentially a reference book, much of it being devoted to a detailed consideration of 58 vegetation relevés from Zemlya Frantsa-Josifa. Of particular interest is the remarkably detailed and painstaking systematic account of the seasonal development of the flowering plants on this archipelago.

The living tundra is a really excellent, vivid and absorbing ecological account of the Russian tundra. It is written by an acknowledged and evident expert who is clearly alive to the importance of this still largely untouched ecosystem and also its extreme fragility.

Despite dealing exclusively with the Russian tundra – and for that reason alone it is invaluable – the book is essential reading for anyone interested in the Arctic. I myself found particularly interesting and revealing the chapters on tundra landscapes and on snow as an all-pervading ecological factor. The author intersperses animal and plant examples with consummate ease and this familiarity is especially evident and valuable in the long chapter on the diverse relationships between organisms in which he convinces us of the importance of entomophily for many of the flowering plants as well as commenting on the partiality of salmon for drowning lemmings!

Together, these two complementary books provide the first comprehensive account of the Russian Arctic readily available in the west. Both authors have been well served by Dr Löve's readable but unobtrusive translation and helpful introductory notes.

G. Halliday

Comparative plant ecology. A functional approach to common British species. J. P. Grime, J. G. Hodgson & R. Hunt. Pp. ix + 742, with numerous text figures and tables. Unwin Hyman, London, 1988. Price £85 (ISBN 0–04–581028–1).

The heart of this volume is the ecological accounts of British species, each occupying two facing pages, and jointly comprising over three quarters of the book. The majority of the data has been gathered by the authors and their eleven collaborators from the Unit of Comparative Plant Ecology, University of Sheffield, and supported by the Natural Environment Research Council. This collaboration, over 25 years, has resulted in directly comparable data for 281 species, and is summarised, with data for a further 221 species, in a succeeding chapter. The accounts are preceded by four introductory chapters. Study of these is fundamental to understanding the ecological background and theory implicit in the accounts.

Data are of three types and are described in detail in Chapter 2. Firstly there are field records, mainly gathered from a vegetation survey covering some 3000 km^2 surrounding Sheffield and encompassing the range of habitats across the lowland – upland boundary of the Pennines and a wide range of bedrocks and associated soils. The authors point out that this sample area is representative of a much wider area of Britain. These data have been used to produce for each species a habitat diagram with 32 categories, corresponding to single land use/habitat categories; from the same data set are derived histograms showing altitude range, occurrence by slope angle, aspect, bare soil, hydrology and soil pH, together with tables of abundance in each of seven major habitat types. The second group of data come from standardised experiments, providing germination data, occurrence in a soil seed bank, relative growth rate and, unusually for ecological work, 2C DNA amounts. There is also a wide range of information taken from the literature, including phenology, chromosome number and floral dispersal mechanisms.

All these data would be sufficient justification for an autecological flora, yet the introductory chapters make clear that the driving forces for this work have been "plant strategy concepts

developed at Sheffield, which have been used to provide a unifying conceptual frame-work". Chapter 1 sets out the history of such concepts and explains the C-S-R model 1 (competitor – stress tolerator – ruderal) developed by Grime in his book *Plant strategies and vegetation processes* (1979), and depicted here as a 'triangular ordination' diagram, set symbolically in the centre of one page of each species account. The three sides of the triangle, originally referring to the relative importance of competition, stress and disturbance are, however, discarded for derived measurements which have been calculated on the basis of a circle of 91 hexagons superimposed on a symbolic triangle. Non-professional ecologists will find this heavy going and it may well have been more successful to have maintained the simpler triangular representations of Grime's earlier work.

A more serious concern is the treatment of trees and shrubs. Of only twelve included in the main accounts (which exclude species such as *Corylus avellana*, *Ilex aquifolium*, *Prunus spinosa* and all *Rosa* species), *Betula* and *Quercus* only appear as genus accounts, while the single *Salix* account includes both *S. caprea* and *S. cinerea*. The chief reason for this treatment is the use throughout the vegetation survey of a $1m^2$ quadrat which only included seedlings and small saplings. In view of the importance of trees and shrubs in colonising and dominating unmanaged lowlands, such a treatment is disappointing, even though balanced to some extent by inclusion of published data.

The autecological value of this book is obvious. Yet for the authors this is only a starting point. Chapter 4 deals with 'the interpretation and use of autoecological accounts'. Proposals range from a suggestion that family history (in an evolutionary sense) will emerge as an important influence on the present characteristics and contemporary ecology of individual species, to a substantial discussion of the relationship of DNA amounts to ecological characteristics. Also included are discussions of phenology, regenerative strategies and germination. One will not agree with everything that is said here. We have given you the bricks and tools, together with some plans, say the authors. It is up to you to build, make other bricks and other plans. This book will be used for these purposes for many years to come.

T. T. Elkington

Somerset ferns, a field guide. Pat Hill-Cottingham. Pp. 84, with many text-figures. Somerset Archaeological and Natural History Society, Taunton. 1989. Price £2·50, post paid £3 (ISBN 0–902152–15–7).

This attractively produced booklet is a comprehensive guide to the ferns (not the horsetails nor club-mosses) of the county. With an excellent cover illustration in colour of *Oreopteris limbosperma* and printed on good quality paper which makes it a pleasure to handle, it should stimulate the local study of ferns. It is strictly for use in Somerset, excluding all species not currently occurring in the county. It seems a pity that it excludes *Adiantum capillus-veneris*, of which several long-established colonies occur in Somerset.

After a very readable and well illustrated introduction on the life-cycle of ferns there are dichotomous and multi-access keys to identification, followed by detailed descriptions of all the species covered, in alphabetical sequence of genera and of species within genera. Each species is illustrated by reduced photocopies of actual fronds: these are mostly very satisfactory, though the frond chosen for *Dryopteris carthusiana* is atypical and fails to show the distinctively narrow parallel-sided shape which contrasts with the more triangular frond of *D. dilatata*; and the blobs depicting *Azolla* are not very helpful, though in this case there is an enormously enlarged line-drawing as well. The book concludes with useful sections on the conservation, propagation and cultivation of ferns, a very ample glossary (was it necessary to define 'triangular'?), lists of synonyms and a bibliography.

Unfortunately the book is marred by numerous misprints, and even the *errata* slip enclosed fails to correct *inter alia* the dichotomous key, in which errors remain in couplets 7 and 16.

Although the two sub-species of *Asplenium trichomanes* are mentioned (both occurring in Somerset), they are not differentiated. The *Polypodium* hybrids are dealt with in some detail, but there is no mention of *Dryopteris* or *Polystichum* hybrids, some of which certainly occur in the county. A note on the *Dryopteris affinis* complex curiously tells us which is the commonest subspecies in Scotland, but makes no reference to Somerset.

There is a useful map of the county showing the vice-county boundary, although the accounts of distribution of each species are not consistently on a v.c. basis. Since the synonymy in Appendix 2 is intended to help the reader "to identify descriptions in old books" it should surely have included the specific name *montana* for *O. limbosperma*, the name used in many older fern books. However, these are all minor criticisms; the text is sound and the book well worth its modest price for local botanists.

R. M. Payne

A Flora of Wensleydale. A centennial review of the plants of the Dale. D. Millward. Pp. 180, with 2 maps. Yoredale Natural History Society. 1988. Price £3 (ISBN 0–9514287–0–5).

This neat, compact flora marks the centenary of the publication in 1888 of John Percival's original flora in *The Naturalist*. The meat of the flora comprises a 118 page listing of the species present, with simple qualitative assessments of the present status of all species of flowering plant and fern according to the categories 'abundant', 'common', 'occasional', 'rare', 'very rare' and 'no recent record' (i.e. since 1985). In the assessment, individual sites are rarely mentioned, grid square references are not listed, nor are the sources of modern records. One of the better entries is for *Primula farinosa* (Bird's-eye Primrose) – "*Frequency* – occasional. In damp pastures and meadows on limestone or glacial till and in calcareous flushes, from 150m at the river in Aysgarth to 570m at Jeffrey Pot. Percival recorded the species as "abundant in many places in the valley" but it is now very rare below 250m due to draining, as at Rabbit Warren, Carperby". Such an entry enables a broadbrush understanding of the 'then and now' status of selected species. The flora would have been greatly enhanced by the presentation of a summary table of those species whose distributions have been drastically reduced, extinctions, and extension of ranges due to more detailed recording.

A pleasing feature is the inclusion of geological and geomorphological maps of the Dale and the appropriate cross-referencing of species distributions related, in particular, to glacial drift and limestone. For example, the entry for *Coeloglossum viride* (Frog Orchid) is informative in ecological terms – "most sites are on glacial till but it has been recorded directly over the limestone, all are below 250m".

The main body of text is followed by a succinct series of essays under the general heading of 'Environmental Setting', comprising 'geological foundation', 'climate', 'soil', 'vegetation', 'geomorphology and vegetation', 'changes over the century' and 'past and present land use and conservation'. The nub of what could have been an important contribution to an understanding of changes in and conservation of the flora, inherent in the titles of the latter two sections, is covered in less than three pages of text. Nevertheless, the book provides another timely reminder that our flora is continually under threat and that only by bold initiatives of synthesis such as this can we begin to make realistic assessments of what has happened, is happening and what needs to be done in the future.

D. W. Shimwell

Developmental biology of fern gametophytes. V. Raghavan. Pp. vi+361. Cambridge University Press, Cambridge. 1989. Price £40 (ISBN 0–521–33022–X).

This is a well written, thoroughly researched book. The title was wisely chosen, as it is a good indication of the content. The emphasis reflects the author's recent interest in the area of spore germination, but morphogenesis, vegetative growth and regeneration, sexuality, and departures from conventional life cycles are well covered. The author focuses on the physiological, cytological and biochemical background of each topic under discussion. This makes for a well rounded text, but one which seldom removes fern gametophytes from the laboratory (and which may therefore have limited appeal for many B.S.B.I. members). "Natural reproductive biology of ferns" covers only a page and a half, and the ecology of gametophytes gets only an occasional mention (but the author did not set out to write for the field biologist). I thought this a pity, considering, for example, the

recent studies that show at least some gametophytes to be considerably more resistant to environmental extremes (and indeed, more widespread) than their sporophytes. The book does help, however, to explode the still widely accepted myth that ferns are self-fertilising, often highly polyploid plants.

The author's enthusiasm for his subject carries the reader fairly painlessly through the more complex biochemical processes crucial to gametophyte functioning, and makes the morphological feats gametophytes achieve sound fascinating. There is a wealth of up-to-date, well-summarised data on each topic covered, and although not lavishly illustrated, the book does make points clearly and simply. There are very few typographical errors, and my only regret as far as production is concerned is the lack of a glossary. If you don't already know what a periplasmodium is, you will not find out from this volume, but if you want a comprehensive set of references to work on the developmental biology of fern gametophytes covering the last forty years, this is the book for you.

I very much enjoyed reading this book, and will find it an invaluable resource for the forseeable future. I can only hope that it finds a market large enough to repay the author's considerable efforts outside those fortunate enough to be asked to review it.

E. SHEFFIELD

Colour identification guide to the grasses, sedges, rushes and ferns of the British Isles and north-western Europe. F. Rose. Pp. 239, with 62 colour plates and numerous text figures. Viking, London. 1989. Price £35 (ISBN 0–670–80688–9).

This book purports to complement the same author's *The wild flower key* (1981), covering the four groups that that book omitted (Gramineae, Cyperaceae, Juncaceae and vascular cryptogams), but it is much more expansive in both text and illustrations, and has a much larger, hardback only, format (24·5 × 19·5 cm). It is very rare nowadays to find a field guide by a good naturalist that does anything like justice to the author's knowledge and experience, and Viking are to be congratulated on giving Francis Rose something like enough space to express himself adequately. There is of course a price to pay for this, and although I think £35 is too much in comparison with some other recent plant guides, it is a good buy if you can afford it and in many respects it is the best book of its kind covering these groups.

The emphasis of coverage is on the British Isles, but extends on the continent from the Loire valley to Denmark and south-east to the Jura. The introductory material includes very helpful accounts of the morphology of the groups, and of the features important for identification. The keys are generally excellent and clear, being both user-friendly and, equally importantly, plant-friendly, avoiding the use of underground parts (although the author forgets his exemplary principles in one place in the *Carex* key and uses rhizome-width as one of the characters). In addition to the main keys there are seven keys to the commoner grasses of various habitats using vegetative characters; this is one of the best sections in the book, and is the sort of item that in the days of reader-friendly publishing would have been additionally printed as a booklet and tucked into a pocket on the back cover so it could be used separately in the field.

The 62 colour plates illustrate 350 of the 420 species in the book. They face the corresponding pages of description and are by Laura Mason, Claire Dalby and R. B. Davis (it is not stated who did which). The six plates of non-*Carex* Cyperaceae, containing numerous detailed drawings as well as the habit paintings, are in a class of their own and quite exceptionally informative and attractive. The grass and rush plates are good, and it is not easy to represent these plants in water-colour. The *Carex* plates are rather less satisfactory, and it is not always easy to guess which species is being depicted without checking the names. There are some annoying inconsistencies, for example in the *C. muricata* group where the short ligule is drawn for three of the taxa but the diagnostic long ligule of *C. spicata* is omitted (though mentioned in the text), and in *C. distans* where the leaf-apex is shown in detail but not that of *C. hostiana* which is again diagnostic in this group. There are a few surprising mistakes in these plates, such as *C. pilulifera* being shown with a sheath to its lowest bract, *C. bigelowii* being shown with a strongly veined utricle, and *C. demissa* being shown with

proportionally shorter leaves than *C. lepidocarpa*. The fern plates are variably successful, those of the filmy ferns being rather misleading, but others, such as those of the clubmosses and horsetails, are good.

The descriptions in all the groups are full of useful and diagnostic detail. My chief doubt about unreservedly recommending the book to all B.S.B.I. members, though, lies in the treatment of the rarer and more critical species. Altogether 70 species described are left out of the colour plates, although details of some are shown in drawings in the text. The Cyperaceae are very thoroughly covered in both text and plates, even such very rare plants as *Carex microglochin* and *C. muricata* subsp. *muricata* being treated in full. But in the vascular cryptogams *Isoetes hystrix* for example, is unillustrated, *I. echinospora* has only its spores depicted, and such widespread and distinctive-looking ferns as *Polypodium interjectum* and *P. cambricum* are unillustrated, as well as unkeyed. In *Juncus* the segregates of *J. bufonius* are unillustrated, although keyed. The grasses are similarly poorly served with such species as *Festuca vivipara*, *Poa angustifolia* and *P. subcaerulea* left out of the plates. This book's direct competitor, R. Fitter, A. Fitter & A. Farrer, *Collins guide to the grasses, sedges, rushes and ferns of Britain and northern Europe* (1984), covers critical taxa such as these much more fully, serves a much wider geographical area, is pocket-sized, and now sells for less than a quarter the price, but in other respects does not reach quite the same standard. The book under review is generally so good that it has a lot to offer even the knowledgeable botanist, although he or she will be just the person most frustrated by its failure to help adequately with the more critical species. Nevertheless, buy it for the diagnostic detail in the descriptions and keys, and for plates 24–29.

A. O. Chater

Norges ville blomster – fra bier og blomster til frø og frukt. [Norway's wild flowers – from bees and flowers to seeds and fruit.] Edited by L. Ryvarde, Oslo. R. Berg & K. Fægri, pp. 240. H. Aschehoug & Co. (W. Nygaard), Oslo. 1989. Price not stated (ISBN 82–03–15976–1).

This book is the first in a planned series on Norwegian plant life edited by Leif Ryvarden. The aim of this volume is to provide the general Norwegian reader with an introduction to the pollination and dispersal biology of flowering plants. Our honorary member Knut Fægri, Emeritus Professor of Botany at the University of Bergen, has written the pollination section (139 pp.), whereas Rolf Berg, Professor of Botany at the University of Oslo has prepared the dispersal section (98 pp.). Both sections are profusely illustrated with many superb photographs contributed by at least 29 photographers and collated by Even Tjørve. Although primarily about the Norwegian flora, examples illustrating particular pollination or dispersal mechanisms are discussed with reference to tropical and desert plants.

This is an excellent book, clearly and concisely written but unfortunately for many B.S.B.I. members only available in Norwegian. The photographs are superb, and many must have been specially commissioned to illustrate particular biological features, especially in the dispersal section. I know of no other book that illustrates so effectively and so elegantly the diversity and beauty of different pollination *and* dispersal mechanisms. Michael Proctor and Peter Yeo's New Naturalist *The Pollination of Flowers* (1973) covers pollination biology in more detail than here, but there is no comparable and readable book on dispersal biology. It is a pity that Latin plant names are used so infrequently in the Norwegian text, as it is tedious to have to use a Norwegian flora to discover what plant is being discussed or illustrated.

It would be wonderful if this book were translated into English. It would then be the first semipopular, up-to-date, and readable book on these important, fascinating, but often ignored topics in plant biology. Congratulations are due to Rolf Berg, Knut Fægri, Leif Ryvarden, and Even Tjørve for producing such a fine book.

H. J. B. Birks

Ted Ellis: the people's naturalist. E. Stone. Pp. 157. Jarrold Colour Publications, Norwich. 1988. Price £3·95 (ISBN 0–7117–0436–8).

This little book is a biography of Ted Ellis (E. A. Ellis), the famous Norfolk naturalist. It is good to see such an excellent biography of Ted. I have known him personally for nearly 50 years, and my wife and I have many happy memories of staying with him and his family many years ago. All those who knew him remember him as a delightful man of great gentleness, simplicity and humour. Though the author never met him, Ted's personality comes through quite remarkably in this book. Eugene Stone based his work largely on interviews with Ted's wife Phyllis, and many others who knew him well. The result is a remarkably authentic biography.

Ted was a unique figure among British naturalists. He developed (and acted upon) the concept of conservation as a youth, at a time when few had even thought about the subject. He put his ideas into practice over many years, particularly at his Wheatfen terrain. Wheatfen has now been bought as a permanent Nature Reserve, and is managed by the Norfolk Trust. His main contributions to serious scientific research come through very well in this book. They were his (often pioneering) studies of many of the smaller fungi, particularly those that cause diseases in plants or in invertebrates.

However, we are told clearly that Ted was a most comprehensive naturalist, with a deep and extensive knowledge of nearly all groups of plants and animals, and of their ecology, in a way that has become very rare in these days of specialisation. Such breadth *and* depth will probably not be seen again in one person. Eugene Stone also tells us much of his life-long contributions to Norwich Museum, in particular the creation of the wonderful dioramas of Norfolk habitats. Such vivid portrayals have never been equalled elsewhere, and have been models which many others have tried to imitate with varied success. He tells also what a wonderful teacher Ted was. He was to my knowledge particularly brilliant with children, and was an excellent radio and television broadcaster. He also makes it clear how essential Phyllis was in all of Ted's life and work; as he says, "any story of Ted's life is also her story".

I have only spotted one small error, in the caption to the lower photograph on p. 77: the man on the right is A. E. (not E. A.) Ellis.

This charming little book is a splendid read, and I would recommend all naturalists to obtain it; to read it is an inspiration.

F. Rose

The European garden flora. A manual for the identification of plants cultivated in Europe, both out-of-doors and under glass. Volume III, Dicotyledons (Part 1). Edited by S. M. Walters, J. C. M. Alexander *et al.* Cambridge University Press, Cambridge. 1989. Pp xv+474. Price £65 (ISBN 0–521–36171–0).

There are many books on the horticultural aspects of garden plants, whereas their taxonomy is a somewhat neglected field. *The European garden flora*, which is planned to comprise six volumes, is intended to be an identification manual for plants cultivated outdoors as well as under glass, and thus fills a long-felt gap in the literature.

Volume III deals with 49 families of dicotyledonous angiosperms (Casuarinaceae to Aristolochiaceae). It is a surprise to see how many families contribute to the garden flora of Europe (there are for example members of the Olacaceae, Didiereaceae and Canellaceae).

According to the main aim of the flora, much effort has been devoted to the contstruction of keys for families, genera and species. These are, indeed, well elaborated. There are – as is usual in floras – strictly dichotomous formal keys which will guide the user reliably to the name of a given taxon. In some medium-sized genera also so-called informal keys are presented, being a guide to some species of the genus on the basis of characters more easily recognised. In the Cactaceae also a key to groups based only on vegetative characters is given. In the genus *Berberis*, some special comments are made for using the key because the species are very difficult to identify. There is a key to the double-flowered variants of the Caryophyllaceae.

The most voluminous families in this volume are the Cactaceae followed by Ranunculaceae and Aizoaceae. The largest genus is *Berberis* with 103 species, followed by *Salix* with 79, *Mammillaria* with 70, and *Quercus* with 57 species respectively. The arrangement of the genera and species is not alphabetical, but is in taxonomic order so that the descriptions of closely related taxa can be easily compared.

In the full-length descriptions of families, genera and species, a terminology is used which will be easily understood also by the layman (there is also a glossary for the inevitable technical terms). Horticultural information is given in a very brief manner only. Literature is presented for each family, and genus and illustrations are cited for each species. Synonyms are given only to a limited extent. English as well as any other vernacular names are lacking. There are remarks on geographical distribution, flowering time, hardiness, infraspecific taxa and hybrids.

Except for four diagrams illustrating terms defined in the glossary, the 42 line drawings (or silhouettes) show diagnostic details of critical genera. Certainly the nine figures of *Salix* leaves, five figures of *Quercus* leaves, four figures of *Ficus* leaves and the inflorescence types in *Berberis*, etc., are extremely useful for determinations within these difficult groups, but this results in a very unequal distribution of figures throughout the text, many families not being represented in figures at all. This seems to be a shortcoming of the book.

The Flora, modelled in outer appearance, size and structure after *Flora Europaea*, is well produced. There are only some minor misprints in the citations of German journals.

Because the selection of species included in this Flora has been very extensive, the book will show its usefulness also outside of Europe. The editors and authors are to be congratulated for tackling such an enormous and difficult task as this Flora. *The European garden flora*, being a major event in the taxonomy of garden plants, will be extremely useful for laymen as well as for professional botanists, and will furthermore act as a stimulus in this field. The following volumes are eagerly awaited, and it is to be hoped that they will come out in the near future.

J. SCHULTZE-MOTEL

Morphology of flowers and inflorescences. F. Weberling, translated by R. J. Pankhurst. Pp. xx + 405, with 193 text-figures. Cambridge University Press, Cambridge. 1989. Price £55 (ISBN 0–521–25134–6).

The comparative study of plant morphology has reached its most elaborate form in Germany, where the fundamental researches of Hofmeister in the middle of last century laid the foundations for the work of Goebel and his pupil Troll. The language used by these workers has always been 'difficult', even for native German speakers; and so it is not surprising that their works have been slow in gaining acceptance outside the German-speaking world. This is a pity, because Troll succeeded in producing an extremely detailed and logically developed system of terminology that, correctly used, could much improve the accuracy and comparability of taxonomic descriptions in Floras and monographs.

Now one of Troll's students, Focko Weberling, has condensed and updated the Trollian concepts of floral and inflorescence comparative morphology in a readable and convenient form. Richard Pankhurst's English version is not merely a translation. The originally extensive bibliography has been considerably enlarged, mostly with recent references, and Professors Weberling and Müller-Doblies have compiled a glossary of morphological terms, because their meaning in German sometimes differs from that in English. The glossary is indeed a help in understanding the frequently complex arguments, although some definitions, e.g. of *acrotonal* and *basitonal*, are inadequate.

Taken on its own terms, this is a marvellous book. It provides, for example, a guide to the comparative study of inflorescences by Troll and his school, when nearly all taxonomists (with the notable exceptions of Laurie Johnston and Barbara Briggs in Sydney) are still at the stage of: open versus closed, cyme versus raceme, thyrse versus panicle.

Its own terms, however, rule out any theory based on floral vasculature. Weberling would appear to subscribe to Goebel's doctrine that vascular bundles arise where they are needed, so there is no question of their being conservative and therefore indicative of ancestral states. He follows the classical Euanthium theory, where the main floral organs are regarded as modified leaves – sterile

(sepals, petals) or fertile (stamens, carpels), and dismisses what he terms Pseudanthium theories (e.g. the Telome, Gonophyll and Anthocorm theories of Zimmerman, Melville and Meeuse, respectively). The Telome theory is not even mentioned, and Melville's work merely "strikes [him] as rather complicated". Weberling does, however, invoke vascular structure where it suits his argument, e.g. in the interpretation of the inflorescence of some *Cordia* species, but not in the interpretation of the inferior ovary. The short discussion of heterostyly makes no mention of the work of Bob Ornduff, and the term 'aril' does not appear at all.

In short, this book provides an entry to, and a summary of, the work of the Trollian school of morphology and its modern manifestations, with regard to the flower and inflorescence. As such, it is an essential source for morphologists and for Flora writers who try to make their descriptions really comparative. The translation reads very well, in general, although not all the 'Germanicisms' have been eliminated. The price, however, may prevent its becoming a university text-book, which it should be.

N. K. B. Robson

Watsonia, **18**, 238–246 (1990)

Obituaries

EVELYN MARY BOOTH
(1897—1988)

The acknowledged contribution of amateurs to British and Irish botany has particular relevance to the life of Evelyn Booth. Coming from an Irish Ascendancy background, she was born in Co. Wicklow, later settling at Bunclody, where Co. Carlow borders Co. Wexford, and here she spent most of her life. Before World War II her interests were centered round horses and pursuits like fishing, though she was always a gardener, and this made it possible for her to extend her interest to wild plants when chance changed her life in the early years of the war. She was recalled from nursing in Essex to care for her ailing mother in Ireland, and at this time met Edith Rawlins, a dedicated and determined member of the Wild Flower Society, who was tutoring families in Evelyn's home county of Carlow, and in neighbouring Co. Wexford. They began to botanise together, Evelyn's considerable energies were engaged, and as her life-long friend and neighbour Daphne Hall-Dare has said, "thereafter, wherever she went, her head was down in search of some treasure".

From this time, in the 1940s, to her death in December 1988, Evelyn Booth never stopped contributing to botany. The early work during the war, hunting and ticking "on slag heaps, bogs and mountains", bicycling to see rarities with her cousin Daisy Barton (also a botanist) and with Miss Rawlins, developed into a most thorough piece of county recording and research. This resulted in a major contribution to the B.S.B.I. mapping scheme in the 1960s, when she covered the whole of Counties Carlow and Wexford, and culminated in the useful and approachable *Flora of Co. Carlow* which was published in 1979. This has the distinction of being the first Irish county Flora to be written by a woman. The final stages of its production were helped by Maura Scannell, herself a major contributor to modern Irish floristic knowledge, notably by her co-authorship of *The flora of Connemara and the Burren* (1983) with Professor D. A. Webb. Evelyn Booth also published notes on finds from various parts of Ireland in the *Irish Naturalists Journal*. A complete bibliography of her work by Dr E. Charles Nelson (himself a good friend and gardening colleague of Evelyn) will appear in *Glasra* **1** (n.s.), published by the National Botanical Gardens, Glasnevin.

It is difficult to single out any one quality which made Evelyn Booth the remarkable character she was. Her place in the lives of countless friends, botanical and otherwise, could never be neatly labelled. A visit to Lucy's Wood, her house above Bunclody and the River Slaney, always involved a whole range of pleasures and interests: her most delightful garden (that of a true plantswoman), her sometimes wonderfully salty humour, tranquil rooms full of books and flowers where she filled visitors with good food and inspiration. A typical memory comes from David Webb, of a botanical meeting for serious work on publications. Of course lunch was provided – an extremely good salmon. Appreciative comments only brought the most casual reply from Evelyn, "Oh I thought you might enjoy one, so I got up early and caught it".

My own long-term memories centre on her courtesy. Even when I was but a child 'woof', and later as a very shy amateur, she always treated me as if there was no doubt that I was a real botanist too. I owe her much of the confidence that has caused me to remain one, and I am sure that others share this debt. More recently, during her last years, I have had the benefit of her indomitable spirit and humour. Suffering a broken hip, uncertain eyesight, and what she complained of as "dicey puff", there was never any withdrawal from plants or friends. How inspiring it was to have a lady of 89 commenting in very modern language on having ripped an arm on barbed wire while making one of her regular seed collections for the National Botanic Garden, and at the same time showing quite youthful excitement about a proposed *Hammarbya* hunt, and berating the insensitivity of her garden help, whom she called "the veg-brutal".

When I was asked to write a tribute to Evelyn, only affection and my own Co. Carlow background seemed to justify my involvement. But during the year since her death, a personal jigsaw has been completed. The pieces in the puzzle have been Miss Rawlins, fanning Evelyn's enthusiasm for wild plants, and coincidentally teaching me Latin names as I learned to talk at the house in Borris where she was tutoring my aunt; the counties of Carlow and Wexford which involved so much of Evelyn's

life, and gave me so much of my early experience of botany; and Evelyn herself, who kept me in touch with Irish plantlife at times when I was far away. In 1989 I became, together with John Akeroyd, B.S.B.I. recorder for Co. Wexford, and the chance this gives me to use and build on Evelyn's work seems to make sense of the gratitude I feel for her existence as both friend and colleague. The power of the amateur tradition, which Evelyn Booth with her lively dedication embodied so finely, must never be underestimated. The continuity, the intricate web of communication and encouragement, can often make valuable sense and records out of apparent trivia. Some two years before her death, when I was gathering biographical information on Miss Rawlins, Evelyn sent me the prophetic present of a tatty old notebook which turned out to be Miss Rawlins' checklist for Co. Wexford. This is proving a rare and valuable addition to the county records, and I will always smile when I think of Evelyn's prescience, and remember the utterly botanical phrase she used when she wrote to say she wanted me to have the notebook "because no-one will know what it is *when I'm over*".

R. FitzGerald

JOHN CAMPBELL GARDINER
(1905—1989)

The death on 4 September 1989 of Jack Gardiner, as he was known with much affection to many of the older members of the Botanical Society of the British Isles, breaks a link with the past in the development of the Society. Although the Society was formed in the middle years of the 19th century, it almost ceased to exist during the period of World War II. A reconstituted society had been formed shortly after the end of the war and was much in need of a period of stability. When a minor crisis arose in 1958 with the resignation of the Honorary Treasurer, a review was made of the then limited membership of the Society and a decision was made to approach Mr Gardiner, of whom nothing more was known to us other than that he had joined the Society in 1949, was a chartered accountant and lived in London. It was left to me as Honorary General Secretary at the time to write to Mr Gardiner, which I did, receiving a reply from Mrs Gardiner saying he was abroad but she thought that he would consider our invitation favourably. That he did so was to be very much to the benefit of the Society and I have never ceased to wonder how fortuitous our choice had been.

Jack Gardiner was born on 20 November 1905 at Shahjahpur in India where his father, following several generations of military service by the Gardiner family, was serving with the Royal Engineers. His father was killed on active service in 1914, during World War I, when Jack was nine years old. As a result Jack was educated at Wellington College, where he developed an interest in science, and for a while he oscillated between following an academic scientific career and entering the business world as an accountant. After qualifying as a Chartered Accountant in 1929, and gaining one of the Institute's prizes in the process, he became a science student at a University Extension Course. There he met his future wife, Marjorie (Wendy) Massey, whom he married in 1933. It was, however, a common love of music rather than test tubes that had brought them together.

The responsibility of marriage made him settle for the business world and Jack became a partner in a City firm of accountants but was seconded to the Ministry of Food in the war years. In 1959, a year after becoming Honorary Treasurer of the B.S.B.I., he was persuaded by Sir Charles Clore to accept the post of executive director of Sears Holdings Limited, an office he was to hold for the following 13 years. By a series of takeovers the concern gained control of much of the British retail trade, including that of footwear, cars and Selfridges. His involvement in the motor industry was somewhat to his own amusement as he could not drive a car and had no desire to do so. He often said that in his youth he preferred to ride horses.

His period of office as Honorary Treasurer of the B.S.B.I. coincided with the closing stages of the Maps Scheme and the publication of the *Atlas of the British Flora* in 1962, which was to prove to be a turning point in the study of natural history. The attentions of the Society were then moving towards problems of plant conservation, causing Jack to play no small part in the fight to try to save Upper Teesdale. In all this time, although living in London, Jack had lost none of an inborn love of the English countryside and with the ties of business relaxed for one day in the week he escaped to the

rural areas near to London every Sunday. This could be the more enjoyable with some object in view and at around the time of the end of the war in 1946 he found this in the study of the flora.

In 1957 the Surrey Flora Committee was formed, its object being to ensure that the Maps Scheme records for that county would be as complete as possible. With the assistance of public transport it was possible to reach many parts of Surrey in the morning and return by another route within one day. He lost no time in assisting the Committee, to which he was co-opted in 1962. By then he had shown himself to be a more than competent field botanist, with his own neatly compiled crib and documented field notes. J. E. Lousley's *Flora of Surrey* was published in 1976, but long before this Jack's advice was being sought in a wider field and his plant studies became broader by extending them to bryophytes which could be studied more fully in the field in the winter months in which Jack felt the same need to escape to the countryside. Above all his interest in Surrey had introduced him to bryologists of the calibre of W. R. Sherrin of the South London Botanical Institute and E. C. Wallace. He joined the British Bryological Society in 1964 and was elected to sit on its Council from 1972 to 1975. His only published work was 'A Bryophyte flora of Surrey', in *J. Bryol.* **11**: 747–841 (1981), which has been described as a model for other local Flora writers. In addition to spending many happy days in the countryside it had entailed much time searching herbaria. With this task completed he turned his attention to Middlesex.

The B.S.B.I., the Surrey Flora Committee and the British Bryological Society were all very much in the control of amateur field workers but another society, the Linnean Society of London, which had royal patronage, rooms of its own, a paid staff, a valuable library and unique collections, was almost entirely in the hands of professional biologists – who nevertheless at times could need advice on other matters. Jack joined the Linnean Society in 1961, being elected to serve on its Council for two periods from 1966 to 1970 and again from 1973 to 1979, a Vice-President 1975 to 1979 and as Honorary Treasurer in that same period. In the year of his death he was the recipient of the Bloomer Award which is given from time to time by the Linnean Society to "an amateur naturalist who has made an important contribution to biological knowledge". More worthy recipients of the award have been few. Otherwise he had given the Society much valuable advice on its publication policy.

In the meantime, having been Honorary Treasurer of the B.S.B.I. for 12 years, he relinquished that office in 1970. He had played no small part in giving some much needed stability to the Society. His last important service to the Society was in helping to persuade Mr M. Walpole, another accountant, to follow him in office. The joint custody for 30 years by two such devoted officers has meant much to the Society.

Jack continued to be as active as he had always been until 1983 when the illness of his wife Wendy, who had been his companion for so many years on his excursions into the London countryside, brought a change. He felt that his place was by her side assisting in any way he could her recovery, until his own final illness overtook him. He was essentially a modest man, being a ready listener with a keen sense of humour. His advice, so often sought by others, was always given with some hesitancy but invariably found to be sound. We shall not see his like again.

Notwithstanding his very full life, Jack was essentially a family man and is survived by his widow, two daughters and a son.

J. G. Dony

CHRISTOPHER C. HAWORTH
1934—1989

Chris Haworth died on 2 December, 1989. He was born and bred in Lancashire, and although he lived long in West Cumbria, and put down many roots there, it was never difficult to recognise his Lancastrian origins. After National Service in the R.A.F., he graduated in Natural Sciences from Queens' College, Cambridge and worked for five years as an industrial chemist with British Petroleum. It was not long, however, before his natural bent drew him into the world where he was to make his indelible mark. Although he had graduated as a biochemist, he became a teacher of biology, first, for three years, in Essex, and then, for some 20 years, at Whitehaven Grammar School in Cumberland. He was an inspiring teacher of young biologists, many of whom now grace

the higher ranks of education, and who would happily acknowledge the debt that they owe to his influence in their formative years.

What made him distinctive as a teacher was the rare combination of, on the one hand, quiet authority in his own subject, and on the other, an intellectual curiosity and incurable desire to stimulate concern about the widest range of cultural, political, and intellectual matters. The liveliness and all-embracing nature of his interests, indeed, was as much in evidence in the influence he had on his colleagues, as in that on his pupils. Whether it was in one of the various unorthodox musical ensembles in which he played the recorder, or discussing the most recent novel that he had discovered, or explaining the potential for computers in education to sceptical colleagues, it would be difficult to exaggerate the beneficient effect that he had on those who came in contact with him, and consequently, the sense of loss felt by so many at his untimely death.

He was the first person that I knew to express a deeply-held philosophical belief in the frailty of the earth's environment, and man's obligation to protect it. There were very few others back in the sixties who shared his doubts about the propriety of leaving radioactive waste as an inheritance for future generations. It was wholly in keeping that he should have been one of the two founding members of the local branch of Friends of the Earth, which he always saw very much more as a positive force in the defence of the environment, rather than just a vehicle of protest. When, however, he felt protest was called for, as at the time of the Windscale Inquiry, this essentially quiet man was quite extraordinarily persistent and single-minded in the enormous amount of effort and skill he put into organizing the local case against the planned development.

As a field botanist, he was an exemplar. He combined encyclopaedic knowledge of most branches of the British flora, a comprehensive first-hand knowledge of a very large area of the Lake District, a meticulous care in the ordering of his herbarium and records, and the skill to execute a programme of garden cultivation in pursuit of further research.

Yet, he combined these skills with such modesty and quietness of demeanour, that there must have been many who were quite unaware of his distinction as a botanist, and few indeed were those who penetrated to the limits of his knowledge. It is difficult to convey the sense of excitement and fun that attended a day in the field with him. It was uncanny how often he would say "I rather feel that there is something interesting around here", to be proved right only a few minutes later. He was pleased, and would have been justified in feeling proud (though that would have been out of character), at the number of times that he had refound plants from 19th century or earlier records.

He was, for many years, one of the leading members of the *Flora of Cumbria* project, in which he was responsible for supervising the recording over a large tract of west Cumbria, much of which, of course, he had recorded in person.

It was through his work on the Flora of Cumbria project that he first became interested in the genus *Taraxacum*. Having, in the early days, sent some specimens for identification, he became determined to master this genus in his area. Over the next eight years, he proceeded, in the words of John Richards, to "transform the history of British Taraxacology," with his unique mixture of ability, energy, enthusiasm, organization and scholarship. He would always, however, insist on emphasising how much, like all taraxacologists, he owed to John's pioneering work in establishing the foundations upon which he worked. He rapidly built up a long list of correspondents, initiated a British *Taraxacum* newsletter, and built up a computer-generated *Taraxacum* database which gave rise to a long series of frequently updated and extensively annotated British check-lists, available to all correspondents.

It was characteristic of Chris, as a taraxacologist, to take nothing for granted. He believed in *no* species until he had thoroughly checked it out for himself! This involved seeing the types of almost all the British species, which in itself led to an extended programme of lectotypification, the fruits of which are at present in press. It also led to extensive travels during which he visited the type localities of many British species, in Ireland, northern Scotland, Orkney and southern England. Like all the best taraxacologists, Chris was an enthusiastic cultivator, who maintained a large and fascinating series of comparative cultivations in pots. He remained entirely sceptical about any species which he had not checked against the type, and which he had not grown alongside its relatives.

Chris's real enthusiasm was for the special dandelions of western Britain, the *Celtica* and *Naevosa*. He discovered, or described, many splendid new taxa; his taxonomic reassessments, based on sound method as well as on inspirational judgement, are far too many to list in full, but he made it

possible to foresee the future publication of an account of the genus in Britain. Although, sadly, he did not live to see it published, he had done enough for us now to envisage the successful culmination of his work in the shape of a B.S.B.I. Handbook of British *Taraxacum*, which his colleagues hope to see concluded, in what will surely be a fitting memorial to Chris's work.

Three years ago, he was appointed to a new post, as Head of Sixth Form at Cockermouth School. Unfortunately, he learnt at the same time of the illness that was to prove fatal, and he was never fit enough to take up the full burden of his new office. Even so, few realised how ill he was and he characteristically fought his illness with inspiriting courage to the very end. He carried on an international correspondence, he continued to act as referee for *Taraxacum*, and he continued, though less and less strenuously, to botanise in the field. He never complained, and very few were allowed to realise how near the end was.

Even more important to Chris than his botany was his home and family, of whom he was intensely proud; his hospitality and that of his wife was renowned, and there was always a welcome for family, friends, neighbours or colleagues. The support of his family, and in particular of his wife, Bertha, in his last illness were incalculable. Happily, he acknowledged something of the debt that he knew he owed her by the naming of the Cumbrian Dandelion, *Taraxacum berthae*.

One of his last full days out was last July, at Wasdale Head, for a field meeting with many friends on the *Flora of Cumbria* project. It was a heavenly Lakeland day, cloudless and windless; the surface of Wastwater was like glass. While the more energetic left for the high fells, Chris, by now much weakened, was perforce confined to the lowland tetrad at Wasdale Head itself. When I pointed out the list of previous distinguished recorders on the card, and suggested that, in what must in any case be one of the most visited tetrads in the county, we weren't likely to find very many new records, Chris cheerfully expressed greater optimism, and within a hundred yards, said, "What about that, for instance?" Needless to say, it was a new record, and, by the end of the day, we (more usually, he) had found a further 20 records for the square. It was a fine day by which to remember him.

A. Dudman

C. C. Haworth's contribution to the *Flora of Cumbria*

Sixteen years ago, Chris was the first to respond to my appeal for recorders for the *Flora of Cumbria* project. So began a close and productive friendship during which he accumulated, almost single-handed, the bulk of our west Cumberland database. It was a friendship nourished by frequent letters telling of new finds and rediscoveries and enlivened by characteristic flashes of his dry wit, but a friendship overshadowed in more recent years by the darkening cloud of his illness.

As the flora progressed, and preliminary accounts started to circulate, I particularly appreciated his restraining hand in my more shaky generalizations, verbal infelicities and factual errors. During his last few months, family accounts were dispatched post-haste off the word-processor, and seldom was he more than a few days in replying; but his most impressive achievement was the revised account of Cumbrian *Taraxacum* which, with Bertha's help, he completed and gave me only six weeks before his death. He made the most of his last summer in the field, and we were all amazed at his courage and single-mindedness in travelling to join our August bramble foray in the far east of the county. It was typical of him that, in rapidly declining health, and with the dandelion account to finish, he should nevertheless want to get to grips with Cumbrian brambles.

His *Taraxacum* herbarium and part of his general herbarium is now with Andrew Dudman, the more important Cumbrian specimens from the latter being in the Lancaster University herbarium (LANC).

G. Halliday

ARCHIBALD GRAHAM KENNETH
(1915—1989)

Archie Kenneth of Stronachullin, near Ardrishaig, Argyll who died on 27 July 1989 at the age of 74, had been a member of the B.S.B.I. since 1957. Field botany was a consuming interest for him and

circumstances allowed him to devote a considerable amount of time to its pursuit. For many years his main energies were directed towards the botanical exploration of the districts of Knapdale and Kintyre, comprising v.c. 101, for which area he was appointed vice-county Recorder in 1961. This work led first of all to the publication in 1964 of the *Flora of Danna*, an account of the vegetation of a small island in Knapdale in which he had taken a particular interest, and this was followed by a supplement in 1971. In 1979 the *Flora of Kintyre* was published, compiled in collaboration with Miss M. H. Cunningham of Campbeltown. Continuing field work in the vice-county soon created the need for a supplement to the latter Flora and this Archie himself published in 1985 as *Additions to the flora of Kintyre*. Archie had a keen eye for a new or unusual plant and this facility led to the discovery of many a rarity which would have escaped the notice of less observant botanists. The discovery of *Lathyrus palustris* and *Cirsium dissectum* in Knapdale, and the finding of a fine colony of *Diphasiastrum complanatum* subsp. *issleri* in West Sutherland are just a few examples of his talent for turning up things of more than ordinary interest. He was also an enthusiastic and competent bryologist and a very complete list of the bryophytes of v.c. 101 was included in the *Flora of Kintyre*.

Archie developed a special interest in critical plant genera, particularly *Hieracium*, *Taraxacum* and *Rubus*, not merely from the point of view of local Flora compilation but from a genuine and absorbing interest in such groups. This brought him into contact and correspondence with the specialists – Peter Sell and Cyril West for hawkweeds, and Eric Edees for the brambles, all of whom at one time or another enjoyed the hospitality generously extended at Stronachullin by Archie and his wife Janet. On more than one occasion Cyril West accompanied Archie on hawkweed-hunting trips to north-western Scotland, an experience much appreciated by Cyril in his later years. Of all the critical plant groups, that which most caught Archie's attention was the section *Alpina* of *Hieracium*, especially its members inhabiting the rather species-poor hills of Wester Ross and Sutherland. In search of these attractive hawkweeds he would tramp many miles in inhospitable country, perhaps to visit a hill previously unknown botanically, and to find, if lucky, one or more species of this interesting group. This dedication resulted in a greatly enhanced knowledge of the alpine hawkweeds of the north-west and the discovery of several new and as yet undescribed species. It is fitting that one of these is to be named in his memory.

Resulting from the discovery of some puzzling colonies in his home area Archie became very interested in the marsh orchids (*Dactylorhiza*) and after studying populations in western and north-western Scotland he became involved, as joint author with David Tennant and others, in the publication of papers on *D. incarnata* subsp. *cruenta*, *D. lapponica* and the enigmatic *D. francis-drucei* which was shown to be referable to *D. traunsteineri*.

Archie was a rather rare attender at organized botanical meetings, although he rarely missed the annual B.S.B.I. Exhibition Meetings held in Glasgow or Edinburgh, where he obviously enjoyed the opportunity to foregather and exchange news with fellow botanists. In the field he preferred his own company or that of one or two companions. During an excursion it was not unusual for him to go off on his own in order to carry out some private investigation or visit a particular spot he had in mind and which the slow (by his standards) rate of progress of the party would otherwise have prevented. Those who have accompanied him in the hills will readily testify to his speed and agility. His stride was deceptively unhurried, but companions were often left trailing far behind. His dress was unconventional by modern standards and consisted of an old pair of trousers, tweed jacket, open-neck shirt, knitted woollen bonnet and, if it looked like rain, an old gabardine raincoat. He never wore climbing boots, preferring a strong pair of brogues or perhaps wellingtons. He travelled light on the hills with no encumbrances such as camera or binoculars, and a small satchel sufficed to carry his lunch and any specimens collected. He was never without a stout hazel crook which he found indispensable in assisting the crossing of burns or reaching awkward places on the crags.

Like his mother, Katherine Graham-Campbell of Shirvan, Lochgilphead, Archie was a keen cultivator of rhododendrons, and many fine specimens grow in the moist, wooded environs of Stronachullin. His other absorbing interest was the music of the highland bagpipe of which he was a very competent exponent in his younger days. Latterly an affliction of the tendons of the hands meant that playing to a high standard was no longer possible, but he remained a well-known composer of pipe music and was much in demand as a judge at piping competitions throughout Scotland.

Archie Kenneth was a fine Highland gentleman of a style becoming increasingly rare. We shall

miss him for his kindly, unpretentious manner and cheery companionship in the field, and Scottish field botany will be the poorer for his passing.

PRINCIPAL PUBLICATIONS OF A. G. KENNETH

1964 The flora of Danna. *Trans. Bot. Soc. Edinb.* **39**: 489–501.
1970 (With A. McG. Stirling) Notes on the Hawkweeds (*Hieracium* sensu lato) of western Scotland. *Watsonia* **8**: 97–120.
1971 The flora of Danna – a supplement. *Trans. Bot. Soc. Edinb.* **41**: 155–164.
1979 (With M. H. Cunningham) *The flora of Kintyre*.
1983 (With D. J. Tennant) The Scottish records of *Dactylorhiza traunsteineri* (Sauter) Soó. *Watsonia* **14**: 415–417.
1984 (With D. J. Tennant) *Dactylorhiza incarnata* (L.) Soó subsp. cruenta (O. F. Mueller) P. D. Sell in Scotland. *Watsonia* **15**: 11–14.
1985 Additions to the flora of Kintyre. *Glasgow Naturalist* **21**: 1–12.
1985 A hybrid club-moss, *Diphasiastrum* × *issleri* in Scotland. *Glasgow Naturalist* **21**: 101.
1986 (With M. R. Lowe & D. J. Tennant) The status of *Orchis francis-drucei* Wilmott. *Watsonia* **16**: 178–180.
1987 (With D. J. Tennant) Further notes on *Dactylorhiza incarnata* subsp. *cruenta* in Scotland. *Watsonia* **16**: 332–334.
1988 (With M. R. Lowe & D. J. Tennant) *Dactylorhiza lapponica* (Laest. ex Hartman) Soó in Scotland. *Watsonia* **17**: 37–41.

A. McG. Stirling

A. G. KENNETH – AN APPRECIATION

Archie Kenneth has contributed more to our knowledge of the *Hieracium* flora of Scotland than any other botanist since before World War I. Starting in his native Kintyre and moving on to Argyll, Perth, Inverness, Ross and Sutherland, as well as some of the islands, he developed an eye for hawkweeds in the field which brought him a wealth of new records, and resulted in a joint paper with his friend of many excursions, Allan Stirling. Nothing seemed to be too much trouble for him, and if more material of a plant was requested, off he would go the following year in search of it, however long and arduous the walk.

One of his important early finds was a new species, *H. solum*, a disjunct member of the Series *Alpestria* found only in two localities in Kintyre. Some of his other most important finds are in Ross, and contain several new species still to be published. My last letter to him was to inform him that one of them was to be called "*kennethii*".

Archie had a wonderful way with people. He even controlled Mary McCallum Webster on a B.S.B.I. excursion, giving her all manner of excuses why he had not taken the party to see the Danna dactylorchids. He explained afterwards, that actually he was taking me the next day so that I could look at them in peace without any outside distraction. I prayed that Mary would not find out, but that thought did not seem to bother him at all. He holds a special place in my heart for the way he enabled Cyril West to continue looking at living hawkweeds long after he was unable to get to them himself. His wife even cooked special dishes that Cyril was fond of to keep him happy during his stay at Stronachullin.

Archie loved his coffee, and I can see him now, explaining to the manageress of a Ross hotel that a demi-tasse was no fit amount of drink for a man who had been on the hills all day. For the rest of our stay at least, everyone in the hotel dining room had a large cup of coffee (or two) if they wanted it.

May I give a special thank you from those south of the border, like myself, who benefited by his quiet and happy companionship in the hills.

P D. Sell

GUY MALCOLM SPOONER
(1907—1989)

All who knew Malcolm Spooner will mourn the death of a distinguished marine biologist, a remarkable and versatile field naturalist, and a formidably knowledgable but unassuming and immensely likeable man. Born in Yelverton, Devon, on 26 June 1907, he was educated at Charterhouse School and Christ's Collge, Cambridge, where he graduated with a First in Zoology in 1929. On leaving Cambridge he joined the staff of the Plymouth Laboratory of the Marine Biological Association, where his work included pioneer research on the genetics of gammarids and, after the war, investigations of the uptake of radioactive fission products by seaweeds. He was awarded the M.B.E. for his wartime code-breaking work at Bletchley Park. He and his botanist wife Molly were married in 1943. For many years he edited the *Journal of the Marine Biological Association*. Outside his professional field, he was a fine entomologist, with a wide field knowledge of diverse groups of British insects, and he was elected a fellow of the Royal Entomological Society in 1959. He was a leading authority on British aculeate Hymenoptera, and it was through his useful papers on various genera of these insects that I first came to know of him in my student days. Later, he was quick to correct the identification of a hoverfly I had miscaptioned. It was he who first showed me a brown hairstreak butterfly, and the rare ant *Formica exsecta* on field excursions in Devon. I well remember his keen pleasure in the flies and solitary wasps on the umbels of *Angelica* which grew in their comfortably natural garden at Yelverton – and in the *Gymnocarpium dryopteris* which had long become naturalized in the shade of the house.

Malcolm Spooner's botanical activities were centred on his native south-west Devon. Wistman's Wood on Dartmoor was a particular and abiding interest. He had known the wood for many years when, in late summer 1964, we sat talking among the gnarled oaks with two Nature Conservancy staff, who expressed misgivings at the wood's apparent state of decline. Malcolm's very characteristic response was to seek out the sites of old published photographs of the wood, and to take comparable new photographs from the same spots. These showed what surprised almost everyone at the time; that, far from receding, the wood had almost doubled in area since the early years of the 20th century. Malcolm and Molly repeated the measurements in the wood made in the early 1920s by R. H. Worth, and over the years he built up a comprehensive bibliography of the many references to the wood in botanical and topographical literature. The results of this work appeared in a paper of which I was privileged to be a joint author in the *Transactions of the Devonshire Association* for 1980. In 1953, he and F. S. Russell re-edited the published papers of R. H. Worth as *Worth's Dartmoor*, still a valuable reference work on the Moor. After his retirement from the Plymouth Laboratory, Malcolm devoted much time and many miles' walking to recording the flora of the Dartmoor tors, and he and Molly made an important contribution to tetrad recording for the *Atlas of the Devon Flora*.

He was for 15 years a member of the Dartmoor National Park Committee. For many years he was active in the Devonshire Association, whose *Transactions* he edited from 1967 to 1972, and of which he was President in 1979. He was a founder member of the Devon Wildlife Trust, and a valued and active member of its Council.

M. C. F. Proctor

ANNA YOUNGER
(1901—1989)

The death of Mrs Anna Younger has removed from the Scottish botanical scene a true stalwart who was deeply revered and much respected, who was untiring in her efforts to encourage field botany, particularly in Scotland, although her interests were by no means confined to that country.

She was deceptively frail in stature and uncomplainingly bore the scars of several field accidents, but she remained a person of unbounded determination in searching for and finding the rarest species in the British flora.

Even when in her late eighties, she was accustomed to dash off to see plants in any corner of the British Isles when a finding of a new species to her meant a further drawing in her Bentham &

Hooker Illustrations. In her haste, she had several brushes with authority from which she managed by her charm to escape conviction! She was, however, no mean botanist and she was a particularly keen student of critical groups such as the genera *Carex* and *Potamogeton*.

She was a most generous patron of the Arts and local charities, and she herself had a high reputation as an accomplished embroideress. She will be much missed within the wide circle of her friends in Scotland.

G. Taylor

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Presidential Address, 1990

D. A. WEBB

GENERA, HOLLOW CURVES AND BOOJUMS

Fellow-botanists,

As most of you know I live in a remote western isle, and have not been able until today to attend a Presidential address. When I inquired what would be expected of me, some said that I should instruct, others that I should challenge or puzzle, others again that I should amuse. Unwisely, perhaps, I have tried to combine all three, and I can only hope that the resulting rather ill-mixed cocktail may contain at least one flavour to everybody's taste.

What is a genus? That is the question to which I want to devote most of my address. Hollow curves and boojums will be touched on, but they are only incidental décor, designed, in the immortal phrase, to give artistic verisimilitude to an otherwise bald and unconvincing narrative. Most of us, I imagine, take species more seriously than genera: we argue passionately for or against the recognition of species A as distinct from species B, but on disputed points such as whether we say *Scirpus caespitosus* or *Trichophorum caespitosum* we are apt simply to follow our favourite Flora, as if it had been written on stone and handed down from Mount Sinai.

What, then *is* a genus? The standard reply is that it is the rank in the agreed taxonomic hierarchy which stands between the family and the species. Fair enough, but this tells us only the relationships of the genus, not its essence. What does it look like? How do you know when you have caught one?

Until recently many people would have replied: it is the primary and basic unit of plant classification. It is the plain man's concept of a distinct 'kind' of plant, whereas what we call species he usually thinks of as *varieties*. A genus has, after all, the form of a noun, under which species are distinguished by adjectives. "A rose is a rose is a rose" said Miss Gertrude Stein, and broadly speaking she was correct. By this I mean that any plant which the plain man calls a rose without qualification (and thus excluding rock-roses, roses of Sharon and so on) belong to the genus *Rosa*. (I am aware that some people transfer *Rosa persica* to the genus *Hulthemia*, but personally I am not convinced.) Conversely I mean that the plain man would recognize as a rose any plant belonging to the genus *Rosa*. (Of course if the plain man is too plain he may simply call it a briar, and include under the same head species of *Rubus* or even *Smilax*. But we must postulate a plain man who gives at least a cursory glance at leaves, flowers and fruits, and not merely at the condition of his clothes.)

This suggests that a genus is the aggregate of all those plants which the observant but uninstructed layman denotes by a vernacular name. Let us see if we can find other genera as satisfactory in this respect as *Rosa*. What about *Viola*? Most of its members are regarded as violets, but although few taxonomists want to raise the subgenus *Melanium* to the level of genus, gardeners and unsophisticated wild-flower-lovers usually distinguish violets from pansies. Well, what about *Ranunculus*? Many of its species are plainly buttercups, but the white-flowered aquatics are not, and what about the Lesser Celandine? If we go abroad the case is even worse. When I was in the Lebanon in spring many years ago I saw, as I imagined, sheets of scarlet anemones. It was not till I chanced to see the calyx of a flower that had been trodden down that I realized they were *Ranunculus asiaticus*. But they were certainly not buttercups. Finally, let us consider the gentians. In the good old days (by which I mean, of course, the days when I learnt my botany) all those blue jobs with campanulate or stellate flowers were species of *Gentiana*. But then some bright boys at Cambridge decided to resurrect Moench's long-dead genus *Gentianella* and apply it to the annual or biennial species with a little fringe of hairs at the top of the corolla-tube. To the plain man, however, they are all still gentians, and it is not easy to persuade him that *Gentiana nivalis* is more closely related to *Gentiana lutea* than it is to *Gentianella amarella*. Indeed I sometimes wonder myself whether it is.

This leads me on to another suggested criterion. Many botanists today, when discussing these questions, say that a good genus should have what it is now fashionable to call a characteristic 'jizz'. This is, of course, what the plain man relies on when he sorts plants into 'kinds'. But the examples

just considered show that while many genera have this characteristic 'jizz' there are many others that do not. I do not think that anybody questions the inclusion in the genus *Fuchsia* of both *Fuchsia excorticata*, which can grow into a tree of 15 m, and *Fuchsia procumbens*, a creeping herb rarely more than 1 cm off the ground. They agree in floral structure, but in little else. We just have to accept the fact that from this point of view some genera are satisfactory and others are not, and that no amount of tinkering will make them entirely satisfactory.

It is, of course, easy to find plenty of smallish genera whose species all look much the same to the plain man. *Myriophyllum* is one such, even when surveyed on a world-scale. But the allegedly popular name 'water-milfoil' is redolent of the book rather than the ditch. The Latin name was formed by Clusius in the 16th century; the English equivalent has been widely used for *Hottonia* and *Utricularia* as well as for *Myriophyllum*. But the plain man either ignores these plants or calls them "one of them mucky water-weeds."

This is all rather disconcerting to the seeker of the generic concept. The gentians teach us that a genuine popular name can straddle two genera, and indeed we know that already if we call to mind pimpernel, loosestrife and celandine. Moreover, not all members of a genus share the same vernacular name: primrose and cowslip are old names firmly established, but nobody questions the inclusion of both in *Primula*; Bentham, indeed, wanted to unite them in a single species.

I might say here, in parenthesis, that it is not always easy to say whether a name is truly vernacular or not. We can easily recognize and reject such nineteenth-century inventions as 'few-flowered spike-rush'; nobody ever talked of a spike-rush till Bentham was driven to invent an English name for *Eleocharis*. But what about 'goosefoot'? Is it a relatively late translation from the Latin, or is *Chenopodium* a Latinization of an old vernacular name? To answer such a question needs a lot of research in early herbals and in dictionaries – not only English, but also German and Swedish. It would appear in this particular case *hahnenfuss* is an old German vernacular name; it was latinized in the 16th century and then, relatively recently, translated to English. This is a warning against insularity, a point to which I will return later. It is also easy to fall into the error of assuming that because an English name is very familiar, and understood by many whose knowledge of botany is slight, that it must be vernacular. 'Saxifrage' provides a good example. Until the mid-eighteenth century the use of the word in English was confined to *Saxifraga granulata*, and in this sense it was certainly a translation by Gerard of the *Saxifraga* used in medieval herbals. Linnaeus was the first author to give the genus its modern circumscription, and it is a bit much to suppose that the untutored sheep-farmers of Cumbria were applying the name saxifrage to such species as *Saxifraga aizoides* or *Saxifraga stellaris*, when Ray and Tournefort were firmly including the first in *Sedum* and the second in *Geum*. Still less likely is that they were calling them rockfoils, as William Morris would have wished.

There are indeed some English names beloved and cherished by Flora-writers which I find it difficult to regard as truly vernacular. I try to imagine myself hearing Farmer Hodge in the Plowright's Arms saying: "It's the wettest April I can remember; the stream by the cow-byre is nigh choked with blinks already". I try, but I find it difficult. And I am reassured when I discover that 'blinks' as a name for *Montia* was more or less invented by Hooker.

If, bearing all these cautions in mind, we make a list of genuinely vernacular names we find that many, indeed, do correspond fairly closely to modern concepts of a genus, but there are almost as many which designate a single species, and are not applicable to other species of the same genus. On the one hand we have buttercup, clover, lime and poppy, with a generic denotation; but against these we must set weld, tutsan, sycamore and meadow-sweet, which denote only a single species within a somewhat varied genus. The fact that many British plants, common enough to have been given a vernacular name, belong to genera of which there is only one British species introduces an ambiguity, but personally I find it hard to believe that such names as sea-kale, horse-radish, traveller's joy or kingcup would be applied to other species of *Crambe*, *Armoracia*, *Clematis* or *Caltha* if we had them.

Linnaeus attached tremendous importance to the genus as the corner-stone of taxonomy, and a few modern authors are inclined to follow him blindly. But we should remember the tag *Vixere fortes ante Agamemnona*: Agamemnon was not the first of heroes, nor was Linnaeus the first of taxonomists. He was not working on a *tabula rasa*, but was to some extent in thrall to his predecessors – not only men like Ray and Bauhin, but also to the unknown Greeks who distinguished parsley from hemlock. Walters (1961) has done a useful service in emphasizing this;

but I cannot follow him when he affirms his adhesion to Linnaeus' view of the genus as the cornerstone of taxonomy. For I am convinced that if there is a single fact which the so-called 'New Taxonomy' (now just over 50 years old) has taught us, it is that the species has (in most cases) an objective reality which other ranks do not possess. Talk as much as you like about *Euphrasia* and *Festuca*, it remains true that the great majority of plants fall into groups which are interfertile within the group but reproductively isolated from other groups, and which are morphologically distinctive and only moderately morphologically variable. These are what we call species, and they represent our primary data. A saying is attributed to the German mathematician Kroneker, that God made the integers, but all else is the work of man. Substitute 'species' for 'integers' and, if you like, 'evolution' for 'God', and I believe the statement to be true.

So far I have been explaining, with some diversions, what a genus is *not*. It is time to return to my original question. I can only answer it by saying that a genus is a convenient bundle of species, with enough features in common for us to be able to apprehend the bundle as a unit and to make some generalizations about it. This description could, of course, be applied to a tribe or a section as well as to a genus, but nobody bothers about tribes or sections until genera have been established.

The difficulty lies, of course, in the word 'convenient'. A bundle of species convenient to one man may be inconvenient to another. I need only remind you that the gardener finds it convenient to keep his Cactaceae and Crassulaceae in the same greenhouse, while the taxonomist finds it convenient to put them in different volumes of his treatise. A generic bundle which is convenient to the man obsessed with chromosome numbers is likely to be inconvenient to the pollen electroscan man or the phytochemist. We find ourselves, whether we like it or not, in the shifting sands of tradition, common sense, consistency and the fight between stability and improvement.

Walters (1961, 1986) has considered the opposition between these last two, and has come down fairly heavily on the side of stability. It is an attitude with which I have a lot of sympathy, but I think that he skates lightly over some difficulties. To begin with, is it reasonable to accept improvements made fairly recently, which in their day were looked on as just as disturbing as those which it is now proposed to reject? I am reminded of Tansley's famous answer when he was asked what exactly he understood by conservation. "It usually means", he replied, "keeping things much as they were when the speaker was young." Some 50 years ago Gilbert-Carter described Hooker's *Student's Flora of the British Isles* as "the only Flora fit to be put into the hands of a student", but it is rather disconcerting to see how many genera which most of us take for granted today are not recognized by Hooker: they include *Sinapis*, *Filipendula*, *Aphanes*, *Sorbus*, *Berula*, *Knautia*, *Cirsium* and *Vulpia*. And I am talking, of course, not merely of nomenclatural but of taxonomic distinctions. The general acceptance of these genera suggests that the improvements of this century have been useful and welcome. For this reason I have some hesitation in deciding that a line must be drawn just now.

But I hold that new generic fusion or splitting should be done only for a very good reason. In *Flora Europaea* we had a working rule that if a species couldn't be honestly keyed out without a profusion of 'usually', 'more or less', or overlapping measurements, then it wasn't a good species. I think the same should apply to genera. I am myself responsible for a fusion which is probably not very popular, but when I sank *Peplis* in *Lythrum* it was simply because among the species of south-eastern Europe I was unable to find a clear distinction. I shall return to these genera later.

There is, however, a further and more compelling reason for considering that a 'freeze' of genera in their present form is impracticable. This is the lack of agreement among recent and authoritative Floras and monographs, coupled with the fact that for some groups in some parts of the world there has been no authoritative treatment at generic level for well over a century. It is all very well to say "let us follow Cronquist for families and put an end to disputes", but there is no modern equivalent to the *Genera Plantarum* of Bentham and Hooker. Anybody who tries to sort out into genera a world-wide collection of, say, the Andropogoneae (a tribe of grasses), or – God save us all – certain families of ferns, soon finds that he is forced to take arbitrary decisions because of lack of agreement among even recent revisions. For few of these are world-wide in their scope. It is all too easy to accept as definitively authoritative a scheme based primarily on the Flora of our own region, and perhaps by a taxonomist we know and respect; but this respect may not be shared by taxonomists in other parts of the world. We have with some difficulty digested the relegation by Melderis of our familiar species of *Agropyron* to *Elymus*, but *Agropyron* still exists, and there are many species in Central Asia for which we have no guidance as to their correct generic niche. Again, Californian Floras refuse to recognize a distinction between *Convolvulus* and *Calystegia*, because the

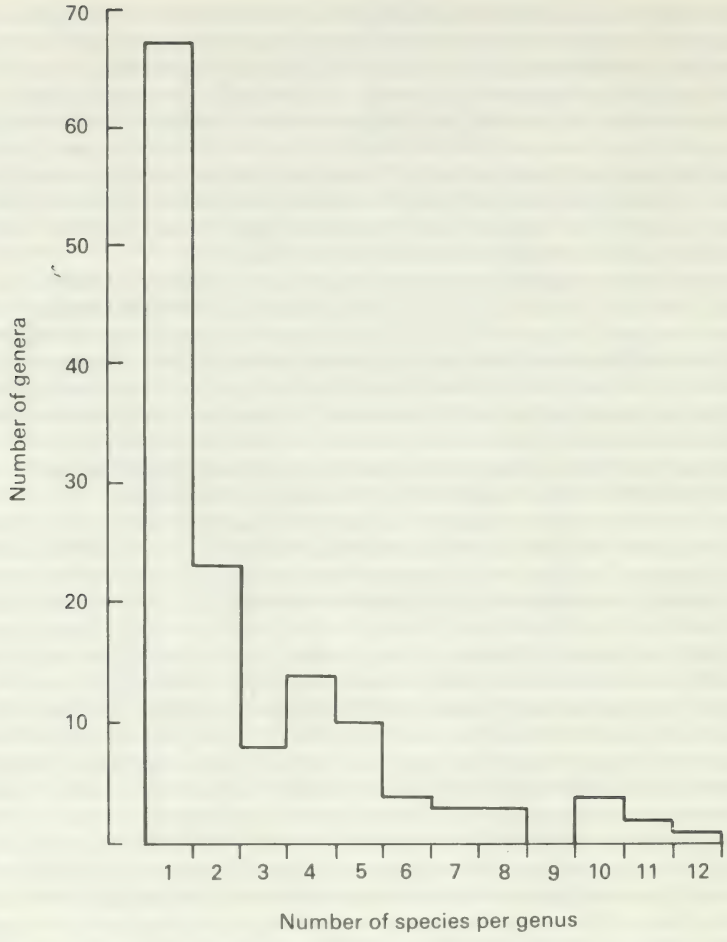

FIGURE 1. 'Hollow curve' for the Acanthaceae, omitting genera with more than twelve species.

distinction, so clear in Europe, is blurred in California. The most widely used, and in many respects the best, Flora of Japan includes *Vulpia* in *Festuca*, and *Reynoutria* in *Polygonum*. A regime of stability if applied everywhere would mean permanent provincialism.

As the detailed knowledge of species advances generic revision must occasionally follow. I have no objection to this so long as the changes are made only when all the evidence has been weighed, and not as a consequence of some idiosyncratic theory, or as a means of getting our name into the next supplement of *Index Kewensis*.

I turn now, very briefly and inevitably superficially, to the topic of hollow curves, and I do so partly because they have lately been in the news, but also because my last point – that we have not reached finality in the delimitation of genera or families – is relevant to our assessment of them. The phrase, 'hollow curve', introduced by Willis (1922) nearly a century ago, indicates a phenomenon to which he was the first to draw attention. In nearly every large family of angiosperms it seems that there are a very few really large genera (that is containing some hundreds of species), a moderate number of middle-sized genera, and a large number of very small genera, many of them with only one species. It follows, therefore, that if you plot number of species per genus against number of genera containing that number of species, you get a curve which, at least at a superficial glance, looks like a hyperbola (Fig. 1). There are various other ways of plotting the same data, but the resulting curve is always much the same (Fig. 2).

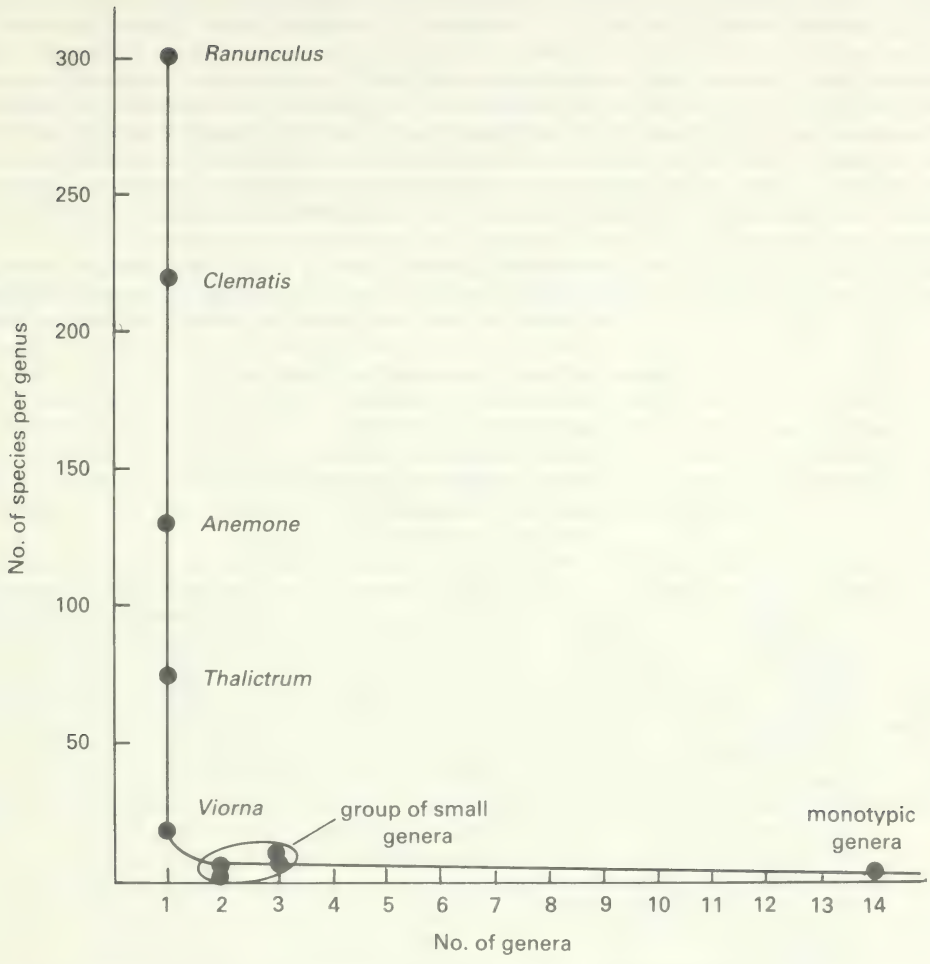

FIGURE 2. 'Hollow curve' for the Ranuculaceae, tribe Anemoneae.

The explanation of this curve was originally proposed by Willis in evolutionary terms which nobody accepts now, but a dispute is current as to whether – as Walters (1986) maintains – the curve is a man-made phenomenon, dependent on the way that our concept of the family and the genus developed, or, as is argued in a recent paper by Cronk (1989), the shape of the curve is at least in part determined by the pattern of variation which exists in nature.

I confess that I find my sympathies divided in this argument, not least because I cannot entirely understand either side of it. My real motive, however, for bringing hollow curves into this address at all is to suggest that both sides are taking too seriously the figures on which their curves and their arguments are based. It is no use imagining that numbers of species per genus and family limits are fixed for ever. Opinion is very evenly divided as to whether we should treat the Papilionaceae as a family, or lump it in with others to make the Leguminosae. Whichever we do, of course, the curves will remain hollow, but some will be hollower that others. Again, pressure is steadily mounting for fragmenting the genus *Polygonum* into five or six, and, as it is one of the two really big genera in the family, if it is dismembered the curve for Polygonaceae will develop something of a middle-aged spread. Table 1, on which Fig. 2 is based, illustrates the same point. It is clear that a number of the monotypic genera are recent splits, and I should be very surprised to learn that they are universally

accepted. Again, Haworth's attempt to split *Saxifraga* into about a dozen genera, made almost 200 years ago, has been taken up by some quite respectable American Floras; if it were followed the hollow curve for Saxifragaceae (a family which, incidentally, everyone delimits differently) would be in a sorry state. None of these considerations will abolish the phenomenon of the hollow curve, but the curves will vary to an extent sufficient to suggest that the somewhat sophisticated mathematical treatment proposed by Cronk rests on a very unstable basis. I would go so far as to suggest that his analysis is of more interest to the applied mathematician than to the biologist. This is not to deny that some of the suggestions and speculations made elsewhere in his paper are interesting and stimulating, as also are those of Walters, but they lose rather than gain by being linked to a geometry which is liable to be upset by the next taxonomic revision.

May I be allowed to end on a rather more frivolous note? I re-read recently that somewhat neglected masterpiece of Lewis Carroll's, *The hunting of the snark*. As many of you probably know it tells of the voyage of a ship to a land where the crew hope to catch a rather mysterious monster – the snark. The crew are an oddly assorted list; all they have in common is that their occupations begin with the letter B. I shall pass over without comment the billiard-marker, the broker, the boot- and the bonnet-maker, but I shall consider briefly the others, who have some relevance to my general theme; these are the beaver, the butcher, the barrister, the bellman and the banker. I take these as symbolizing various types of what I conceive to be the wrong approach to the problems of generic delimitation. The beaver is the man like the late-lamented H. P. Fuchs of Basel, or Dr Josef Holub (whom God preserve) of Prague; such men spend their lives beavering away in ancient and

TABLE 1. SIZE OF GENERA IN RANUNCULACEAE, TRIBE ANEMONEAE, FROM WILLIS (1931)

Genus	No. of species
Ranunculus	300
Clematis	220
Anemone	130
Thalictrum	75
Viorna (*Clematis* p.p.)	18
Adonis	10
Oxygraphis	10
Clematopsis (*Clematis* p.p.)	10
Myosurus	7
Naravelia (*Clematis* p.p.)	7
Rhopalopodium (*Ranunculus* p.p.)	7
Knowltonia (*Anemone* p.p.)	6
Trautvetteria	6
Barneoudia (*Anemone* p.p.)	4
Hamadryas	4
Halerpestes (*Ranunculus* p.p.)	3
Leucocoma (*Thalictrum* p.p.)	3
Anemonanthea (*Anemone* p.p.)	2
Capethia	2
Aiolon (*Anemone* p.p.)	1
Arcteranthis (*Oxygraphis* p.p.)	1
Aspidophyllum	1
Beckwithia (*Ranunculus* p.p.)	1
Gampsoceras (*Ranunculus* p.p.)	1
Kingdonia	1
Kumlienia (*Oxygraphis* p.p.)	1
Laccopetalum (*Anemone* p.p.)	1
Paroxygraphis	1
Piuttia (*Thalictrum* p.p.)	1
Stipularia (*Thalictrum* p.p.)	1
Sumnera (*Thalictrum* p.p.)	1
Syndesmon (*Anemone* p.p.)	1
Viticella (*Clematis* p.p.)	1

obscure literature and coming up with totally unfamiliar names. These are mostly specific epithets, but occasionally they resurrect distressing genera such as *Logfia* or *Ifloga*. The butcher is the man who, when he sees a large genus, has an irresistable impulse to cut it up into joints of household size. This is a very natural impulse, for very large genera are a nuisance; unfortunately, however, some of them seem very resistant to butchery. I am afraid I must typify the butcher by Dostál, a taxonomist for whom I have a considerable respect; but he caused a crisis in *Flora Europaea* by proposing to split *Centaurea* into eight or nine pieces. We allowed him to detach a few small fragments, and he might have got away with the major butchery had he not disclosed that the genus containing several very familiar species was to bear the name of *Sagmen*. At that the committee struck. The barrister is the taxonomist who believes that generic limits can be settled by laws or rules: the rule most frequently put forward is that if two plants can hybridize they must belong to the same genus. If orchids are mentioned the barrister is apt to change the subject. The bellman, who is, incidentally, the captain of the ship, reveals his weakness in his own words:

'Just the place for a snark', the Bellman cried
As he landed his crew with care.
. . . . . .
'Just the place for a snark'. I have said it twice
That alone should encourage the crew.
'Just the place for a snark'; I have said it thrice.
What I tell you three times is true.

We have all come across bellmen, commoner, I am glad to say, across the Atlantic than here, who publish an idiosyncratic generic revision, and then republish it twice in different journals and assume that it is generally accepted. The banker is, like all bankers, a natural conservative. He values stability of exchange and interest rates above all other considerations, and assumes that any change in them will be for the worse. He shuts his eyes to the fact that on many problems of generic delimitation there *is* no general agreement: the yen and the dollar, as we have seen, do not always follow the pound. He also ignores, as I have suggested earlier, the fact that some of the things he regards as lynch-pins of his stable world were regarded by the previous generation of bankers as dangerous innovations. In a different way from the others, but just as confidently, he is sure that his concept of the genus is one with which all right-thinking men must agree.

I have omitted one important member of the crew, the baker. I am afraid that here I must cheat a little, for, although he has some relevance to my main problem, he reminds me most, not of an errant taxonomist, but of a particularly troublesome species. The baker, as some of you may remember, arrived for the voyage with 42 boxes, with his name painted clearly on each, but owing to some misunderstanding they were left behind on the beach. He was wearing plenty of clothes, but without the boxes he couldn't remember his name.

He would answer to 'Hi!' or to any loud cry
Such as 'Fry me!' or 'Fritter-my-wig!'
To 'What-you-may-call-um!' or 'What-was-his-name!'
But especially 'Thing-um-a-jig!'
. . . . . .
His intimate friends called him 'Candle-ends'
And his enemies 'Toasted-cheese'.

I think we all know species to which this applies. I found one when I was writing the Lythraceae for *Flora Europaea*, and I was in doubt as to whether it belonged to *Lythrum* or to *Peplis*. My doubt had been shared by others, as can be seen from its full synonymy:

Lythrum borysthenicum (Bieb. ex Schrank) Litwinov in Maevski, *Fl. Sred. Ross.*, 3rd ed, **5**: 1209 (1917).
Lythrum nummulariifolium Loisel. in *Desv. J. Bot.* **2**: 330 (1809), non Persoon, *Syn.* **2**: 8 (1806).
Peplis borysthenica Bieb. ex Besser, *Enum. Pl. Volhyn.* 81 (1822), nomen nudum.
P. borysthenica Bieb. ex Schrank in *Flora (Regensb.)* **5**: 643 (1822).

P. erecta Req. ex Bentham, *Cat. Fl. Pyr. Bas-Languedoc* 111 (1826), nomen nudum.
Ammania borysthenica (Schrank) DC. in *Mém. Soc. Phys. Genève* **3** (2): 79 (1826).
Peplis australis Gay ex Arnott in *Edinb. New Phil. Jour.* **2**: 250 (1827), nomen nudum.
P. biflora Salzm. ex DC., *Prodr.* **3**: 77 (1828).
Lythrum biflorum (Salzm. ex DC.) Gay in *Ann. Sci. Nat.* **26**: 227 (1832).
Peplis erecta Req. ex Moris, *Fl. Sard.* **2**: 67 (1840).
P. tithymaloides Bertol., *Fl. Ital.* **4**: 233 (1841).
Ammania boraei Guépin, *Suppl. Fl. M.-et-L.* 39 (1842).
Middendorfia borysthenica (Schrank) Trautv. in *Flora (Regensb.)* **22**: 496 (1842).
M. hamulosa Trautv. in *Mém. Acad. Sci. Petersb. (Sci. Phys. Math.), ser. 6*, **4**: 491 (1842).
Peplis nummularifolia Jordan, *Obs. pl. crit.* **3**: 85 (1846).
P. boraei (Guépin) Jordan, *Obs. pl. crit.* **3**: 81 (1846).
P. timeroyi Jordan, *Obs. pl. crit.* **3**: 83 (1846).
P. hispidula Durieu in Duchartre, *Rev. Bot.* **2**: 431 (1847).
Lythrum hispidulum (Durieu) Koehne in *Sitzb. Bot. Ver. Brandenb.* **22**:29 (1880).
Lythropsis peploides Welw. ex Koehne in *Bot. Jahrb.* **1**: 305 (1881).
Lythrum loiseleurii Rouy & Camus, *Fl. Fr.* **7**: 164 (1901).
Peplis australis Gay ex Sampaio, *Fl. Portug.* 305 (1911).
Lythrum boraei (Guépin) Klokov, *Fl. R.S.S. Ucr.* **7**: 401 (1955), in obs.

With such a rich synonymy one can be excused for thinking that the addition of 'Toasted-cheese' to the list would scarcely be noticed.

It will be seen that the species has been assigned to four different genera. *Middendorfia* and *Lythropsis* (which can be regarded as synonymous) represent desperate attempts to find a home for those plants which seem intermediate between *Lythrum* and *Peplis* as traditionally interpreted, but their recognition would merely mean that we had on our hands three genera hard to define instead of two. The fact is that Linnaeus and his predecessors, impressed by the numerous and conspicuous differences that separate *Lythrum salicaria* from *Peplis portula*, put them without hesitation in different genera; it was only the gradual discovery later of various dingier and dingier *Lythrum*-like plants from southern Europe that eroded the distinction and convinced me that only one genus could be maintained. So, in spite of disapproving noises from some conservative bankers I sank *Peplis* in *Lythrum*, and I seem, rather to my surprise, to have got away with it.

I have strayed rather far from the snark and its hunters, whom, I may remind you, I portray as seekers after the concept of the objective, scientific, universally accepted genus. They set about their hunt in a business-like way:

They sought it with thimbles, they sought it with care;
They pursued it with forks and with hope;
They threatened its life with a railway-share;
They charmed it with smiles and with soap.

But they receive a nasty shock when the nameless baker reveals to them a warning given him by his uncle on his deathbed.

If your snark be a snark that is right;
Fetch it home by all means – you can serve it with greens –
And it's handy for striking a light.

But oh, beamish nephew, beware of the day,
If your snark be a boojum! For then
You will softly and suddenly vanish away,
And never be met with again!

The crew were shaken by this, but they resolve all the same to proceed with the hunt. After many adventures they saw the baker gesticulating from a distant crag before he plunges into a chasm.

'It's a snark!' was the sound that first came to their ears,
And seemed almost too good to be true;
Then followed a torrent of laughter and cheers;
Then the ominous words 'It's a boo–'

In the midst of the word he was trying to say,
In the midst of his laughter and glee,
He had softly and suddenly vanished away,
For the snark *was* a boojum, you see.

Well, it is my contention that all snarks are boojums, and that snark-hunting is best abandoned; but by this I do not mean generic scrutiny and possible revision, for I remind you once again that I use the snark as the symbol of the would-be absolute and eternal definition of a genus, determined on *a priori* principles.

Let us recall the nursery rhyme:

One, two, buckle my shoe;
Three, four, shut the door;
Five, six, pick up sticks;
Seven, eight, lay them straight.

Picking them up is the job of the species-maker. Laying them straight is what I have mainly been talking about, if we interpret 'straight' to mean 'arranged in bundles of convenient size and composition'.

"Let us", in the sonorous words of *Ecclesiastes*, "hear the conclusion of the whole matter". Approach the business of generic revision in the spirit in which the 1662 Prayer Book exhorts us to approach matrimony: not unadvisedly, lightly or wantonly, but discreetly, advisedly and soberly. Don't disturb wantonly such bundles as you find, but don't be afraid to make discreet adjustments if you have considered the matter from all angles and are confident that it will improve the convenience of the bundles concerned. Above all, don't go snark-hunting on the basis of a single general principle, for if you do you will deserve, even if you do not actually meet with, the fate of the baker.

REFERENCES

Cronk, Q. C. B. (1989). Measurement of biological and historical influences on plant classification. *Taxon* **38**: 357–370.

Walters, S. M. (1961). The shaping of angiosperm taxonomy. *New Phytol.* **60**: 74–84.

Walters, S. M. (1986). The name of the rose: a review of ideas on the European bias in angiosperm classification. *New Phytol.* **104**: 527–546.

Willis, J. C. (1922). *Age and area*. Cambridge.

Willis, J. C. (1931). *A dictionary of the flowering plants and ferns*, 6th ed. Cambridge.

An account of *Orobanche* L. in Britain and Ireland

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ABSTRACT

Morphological descriptions are given of the 14 species of *Orobanche* (Orobanchaceae) recorded in the British Isles, together with separate keys for identifying fresh material and herbarium specimens. Accounts of the history of the species are presented together with illustrations and distribution maps. The variation in *Orobanche minor* is accounted for with the recognition of four varieties.

INTRODUCTION

The genus *Orobanche* is renowned as a taxonomically very difficult one. In most cases this is a result of many of the useful characters becoming lost on drying, and the lack of adequate field notes. Plants which are very distinct in the field become reduced to a hideous brown uniformity when pressed. Therefore, herbarium specimens are often incorrectly determined (an average of 5–10% in fact). The loss of characters on drying, considerable intra-specific variation, confusing synonymies, incorrectly cited names and badly described species with poor types (often with different species on the same sheet) have done little to generate interest in the genus. Too many botanists have shown a reluctance to deal with this genus in herbaria, perpetuating the myth that the species are impossible to identify once dried. Certainly, *Orobanche minor* Sm. and its close relatives often cannot be positively determined without descriptive notes made at the time of gathering, but all other species from the British Isles are distinct enough not to need any additional information.

It is hoped that this account will stimulate other botanists to study, identify and record members of this fascinating parasitic genus in Britain and Ireland, as well as clear up some errors and confusions made in the past.

If more than one English name is in common usage, then they are all given, but the first is the name recommended by Dony, Jury & Perring (1986).

Chromosome numbers are given where known. Counts from British material (Hambler 1958) are marked by an asterisk. All other counts are from European material (Moore 1982).

Distribution maps are based on herbarium material from **BM**, **CGE**, **E**, **K**, **LIV**, **MANCH**, **NMW** and **RNG**, together with selected records from the Biological Records Centre.

CHARACTERS OF TAXONOMIC IMPORTANCE

Populations of *Orobanche* species are often enormously variable with regard to such characters as size, colouration and pubescence, yet these details are seldom recorded on specimen labels. Because of this variation and their use in the taxonomy of the genus, care should be taken not to rely on a single character in isolation.

Most of the British species have a restricted host range and it is therefore important to identify and record this. Unfortunately, this seemingly simple task is often almost impossible: it is not easy (nor often desirable!) to dig up the plants to observe connections between host and parasite. If the host species has to be guessed, this should be stated, and other surrounding species noted. Too often an incorrect plant has been given as the host and this has wrongly influenced later determination.

Other characters to pay particular attention to include: the overall stature of the plant; the degree of swelling at the base (though where a species has several host species, such as *Orobanche minor*, these host taxa will obviously influence the *Orobanche* morphology); colour and degree of stem

pubescence; length and pubescence of bracts; presence or absence of bracteoles; length, shape and venation of the calyx (though this may vary considerably on a single plant); position, shape and size of the lobes of the upper and lower corolla lips, the height of insertion of the stamens, the position and degree of the stamen pubescence, and the colour and degree of fusion of the stigma lobes.

Pubescence of the anthers has been used as an important diagnostic character for taxa within section *Trionychon* Wallr. but not for those within other sections of the genus (Webb & Chater 1972). All British taxa of section *Orobanche* have hairless anthers.

Preliminary investigations of seed morphology (Rumsey unpubl.) reveal great variability in size and shape from single capsules and preclude reliable discrimination of the taxa considered here with a single exception. *O. ramosa* L. subsp. *ramosa* is distinct in having a secondary layer of reticulation to the surface of the cells and not just the small circular to ovoid pits seen in all other British taxa.

KEYS TO THE SPECIES

Two keys are provided. The first is for fresh material and includes characters not available from herbarium specimens; for these the second key should be used. However, as more reliable characters are included in the first key, this should be used whenever possible.

KEY TO FRESH MATERIAL

1. Flowers with bracteoles; capsule valves free above 2
1. Flowers without bracteoles; capsule valves coherent above 4
2. Stem usually simple, c. 8 mm diameter; corolla narrowly campanulate; on *Achillea millefolium* ..... 3. *purpurea*
2. Stem branched, slender, c. 5 mm diameter; corolla infundibuliform or tubular-infundibuliform; on various hosts 3
3. Flowers 18–35 mm, infundibuliform; pedicels to 20 mm; anthers hairy ..... 2. *aegyptiaca*
3. Flowers 10–18 mm, tubular-infundibuliform; pedicels to 8 mm; anthers glabrous 1. *ramosa*
4. Plant with conspicuous sweet scent 5
4. Plant unscented, or if with a scent, then foetid 7
5. Stigma cream to reddish-pink at anthesis; corolla lips divergent ..... 12. *crenata*
5. Stigma purple, orange or dark-red at anthesis; corolla lips not divergent 6
6. Corolla 20–32 mm; stem yellowish or pale pink; on Rubiaceae ..... 7. *caryophyllacea*
6. Corolla 15–20 mm; stem purplish-red; on *Thymus* ..... 5. *alba*
7. Stigma lobes yellow, at least at first 8
7. Stigma lobes purple, red or brown 13
8. Corolla longer than 18 mm; stems usually 8 mm or more wide; plants usually over 40 cm tall 9
8. Corolla to 22 mm, but usually less than 18 mm; stems less than 8 mm wide, plants usually less than 40 cm tall 12
9. Flowers campanulate; stamens inserted less than 2 mm above base of corolla tube; parasitic on shrubby legumes ..... 4. *rapum-genistae*
9. Flowers broadly tubular; stamens inserted more than 2 mm above base of corolla tube; not parasitic on Leguminosae 10
10. Stigma becoming reddish-purple; lower lip conspicuously ciliate; stamens inserted 2–3 mm above base; parasitic on *Berberis* ..... 14. *lucorum*
10. Stigma not becoming reddish; lower lip at most minutely ciliate; stamens inserted 3–6 mm above base; parasitic on Compositae 11
11. Upper lip two-lobed, lower lip with the middle lobe the largest; style exserted; parasitic on *Petasites* and *Tussilago* ..... 13. *flava*
11. Upper lip entire to shallowly two-lobed, lower lip with subequal lobes; style not exserted; parasitic on *Centaurea* spp., usually *C. scabiosa* ..... 8. *elatior*
12. Stem purplish; flowers with a constricted mouth, spike lax; parasitic on Araliaceae, usually *Hedera* ..... 11. *hederae*
12. Stem yellow; flowers not constricted; spike short and dense; parasitic on Compositae, usually

Hypochaeris ..... 10. *minor*

13. Corolla broadly cylindrical-campanulate, with dark glands distally; filaments glabrous at base, glandular above ..... 6. *reticulata*
13. Corolla tubular or narrowly campanulate, without dark glands; filaments glabrous to hairy below, glabrous above 14
14. Plant very pale, hairy; upper lip porrect; filament bases with shaggy covering of whitish hair; calyx with long filiform limbs; parasitic on *Picris*, and occasionally *Crepis*; very rare 9. *loricata*
14. Plant variously suffused with purple; upper lip forwardly directed; filament bases sub-glabrous, rarely hairy; calyx teeth acute but never filiform; on various hosts .....10. *minor*

KEY TO HERBARIUM MATERIAL

1. Flowers with bracteoles (sometimes lost); corolla constricted just above the ovary; capsule valves free above 2
1. Flowers without bracteoles; corolla, if constricted, then only at distal end; capsule valves coherent above 4
2. Stem usually simple, c. 10 mm diameter; flowers glandular-puberulent ..... 3. *purpurea*
2. Stem usually branched, c. 5 mm diameter; flowers glandular-pubescent 3
3. Corolla 18–35 mm, infundifolium; pedicels to 20 mm; anthers hairy ..... 2. *aegyptiaca*
3. Corolla 10–18 mm, tubular-infundibuliflorum; pedicels usually c. 3 mm; anthers glabrous .. .. 1. *ramosa*
4. Bracts villous; lips of corolla divergent, corolla (14–) 20–30 mm, pale, but lips conspicuously veined ..... 12. *crenata*
4. Bracts hairy, but never villous; lips of corolla not divergent, corollas of various sizes and colouration 5
5. Flowers broader than 7 mm diameter 6
5. Flowers narrower than 7 mm diameter 9
6. Corolla conspicuously campanulate, pubescent; filaments inserted less than 2 mm above base 7
6. Corolla widely tubular to narrowly campanulate, sub-glabrous; filaments inserted more than 2 mm above base 8
7. Stigma very dark, filaments hairy below ..... 7. *caryophyllacea*
7. Stigma pale, filaments glabrous below ..... 4. *rapum-genistae*
8. Corolla with dark glands; stamens inserted 2–4 mm above base, subglabrous below .... 6. *reticulata*
8. Corolla without dark glands; stamens inserted 4–6 mm above base, hairy below . 8. *elatior*
9. Plant to 75 cm; stem to 12 mm wide; flowers in upper third of stem; stamens inserted 4–6 mm above base, filaments glandular above ..... 8. *elatior*
9. Plants almost always less than 60 cm; stem to c. 8 mm wide, occasionally more; stamens inserted less than 4 mm above base, filaments glabrous above 10
10. Stamens inserted less than 2 mm from base; calyx usually entire; stem to c. 25 cm; flowers shiny, dark red-brown ..... 5. *alba*
10. Stamens inserted more than 2 mm from the base; calyx usually bifid; stem usually more than 25 cm; flowers dull, variously coloured, but not dark red-brown 11
11. Corollas usually constricted just behind mouth; spike usually lax with flowers extending for more than three quarters of the stem; usually forming a conspicuous terminal 'bud' .... 11. *hederae*
11. Corollas never constricted behind mouth, spike dense; flowers usually restricted to top half of the stem, without conspicuous terminal bud 12
12. Plants with some darker colouration on stem or flowers ..... 10. *minor*
12. Plants orange-brown, without conspicuous dark pigmentation 13
13. Plant usually greater than 30 cm; corolla to 23 mm, usually c. 19 mm, upper lip porrect; calyx with long filiform segments; flowers densely packed but covering up to half of the stem .... 9. *loricata*
13. Plant usually less than 30 cm; corolla c. 14–16 mm, upper lip forwardly directed; calyx segments acute but never longly filiform; flowers usually restricted to top third of stem .... 10. *minor*

DESCRIPTIONS OF TAXA

1. **Orobanche ramosa** L., *Sp. Pl.* 633 (1753).
Phelipaea ramosa (L.) C. A. Mey., *Enum. Pl. Cauc.* 104 (1831).

English name: Branched Broomrape.

Illustrations: Figs 1A, 4A. Photographs in Polunin & Huxley (1965: pl. 180), Huxley & Taylor (1977: pl. 274); drawings in Sowerby (1794, **3**: t. 184), Martin (1965: pl. 66).

Flowering stem 5–30 cm, slender, glandular, usually branched and with a small bulbous base; yellowish suffused purple from below. Inflorescence rather lax. Bracts ovate-lanceolate, shorter than calyx; bracteoles equalling calyx, lanceolate. Calyx teeth c. 6–8 mm, lanceolate-acuminate, shorter than tube. Corolla 10–15(–17) mm, cream, blue or violet distally, whitish at base, glandular-pubescent, sub-erect at base, erecto-patent distally, constricted in the middle; base inflated, upper lip with two rounded lobes, recurved, lobes of lower lip deflexed, obtuse, entire or denticulate. Stamens inserted 3–6 mm above corolla base, just below constriction; filaments glabrous to pubescent at base; anthers glabrous or sparsely hairy at base. Stigma lobes white or bluish. Flowering July to late September. 2n=24.

Introduced but now extinct in the British Isles. Formerly parasitic on *Cannabis sativa*, when this was grown commercially in East Anglia, but recorded parasitizing over 300 species, including *Medicago sativa*.

The taxonomy of this species has been very confused in the past with over 20 variants having been described. Webb & Chater (1972) have sunk all into three rather ill-defined subspecies. The British and Irish material is referable to subsp. *ramosa*. Webb & Chater suggested that differentiation proceeded along ecological rather than geographical lines. Of these subspecies, two are restricted to southern Europe and N. Africa; only *O. ramosa* subsp. *ramosa* extends as a weed further north, being reported from 25 European countries. However, it is now regarded as extinct in six of the most northern of these, Britain included. The plant can only be regarded as a persistent casual with a lengthy history. It was known to Dillenius (Ray 1724: 288) in Suffolk at Beckles [sic] and was then considered tolerably plentiful. By the time *English Botany* was published (Sowerby 1794) the plant had become scarce and very local. This was a result of the reduction of the once great hemp cultivation in East Anglia. From 1820 onwards, the plant becomes little more than a sporadic casual throughout England, being last recorded in the 1920s. The claim for native status in the Channel Islands was based on a single specimen from La Moye, Jersey collected by A. Webster on 10 June 1913 and housed at **BM**. This was originally determined as *O. purpurea* Jacq. but correctly redetermined by Pugsley (1940). He considered it possibly native, as it was widely distributed throughout France. However, the species sensu lato is restricted as a native to the Mediterranean region and this claim should be dismissed.

Fig. 8 shows the distribution from the literature and specimens traced so far; there is a further unlocalized pre-1900 record from Kent (Philp 1982: 197).

2. **O. aegyptiaca** Pers., *Syn. Pl.* **2**: 181 (1806).
Phelypaea aegyptiaca (Pers.) Walpers, *Repert. bot. syst.* **3**: 463 (1844).

English name: Large-flowered Branched-broomrape.

Illustrations: Figs 1B, 4B.

Flowering stem 15–20 cm, usually branched, slender, glandular-pubescent. Inflorescence rather lax. Lower flowers usually conspicuously pedicellate. Bracts (3–)6–8(–10) mm, ovate lanceolate shorter than calyx; bracteoles filiform to lanceolate shorter than calyx. Calyx teeth to 9 mm long, lanceolate-subulate equalling to exceeding tube. Corolla 20–35 mm, lilac distally, with darker veins, cream proximally, straight or slightly curved, conspicuously infundibuliform in distal part. Stamens

inserted 3–6 mm above corolla base; filaments ± hairy below, sometimes sparsely so above; anthers villous. Stigma lobes white or bluish. Flowering period July to September. 2n = 24. Casual, parasitic on tomatoes and a wide range of other hosts.

This plant has only ever once been recorded from Britain. This was a casual occurrence on tomatoes in St Leonards Nursery near Hastings, W. Sussex in 1952. The plant was discovered by a schoolboy working at the nursery. He removed a small portion which was given to Mr D. Brightmore. This sprig was despatched to Kew for identification (22.9.1952, *Brightmore*, **K**!). Two photographs taken by Mr Brightmore are mounted on a sheet in Lousley's herbarium, now at **RNG**. The plant did not recur. This weedy species from south-eastern Europe may appear again in this country as a casual.

3. **O. purpurea** Jacq., *Enum. Stirp. Vindob.* 108, 252 (1762).
O. caerulea Vill., *Hist. Pl. Dauph.* **2**: 406 (1787).
Phelypaea caerulea (Vill.) C. A. Mey., *Enum. pl. Cauc.* 104 (1831).

English names: Purple Broomrape, Yarrow Broomrape.

Illustrations: Figs 1C, 4C. Photographs in Bichard & McClintock (1975: pl. 51), Petch & Swann (1968: pl. 72); drawings in Ross-Craig (1966: pl. 22), Butcher (1961: 283), Sowerby (1797, **6**: t. 423), Garrard & Streeter (1983: 140).

Flowering stem 15–45 cm, simple, occasionally branched from the base, usually when damaged, glandular-puberulent, mealy, especially above; dark bluish-grey, rarely yellow. Inflorescence dense, usually restricted to the top third of the shoot. Bracts 8–15 mm, lanceolate; bracteoles linear, shorter than calyx. Calyx 8–16 mm, mealy-hairy with lanceolate-acute teeth, equalling tube. Corolla 18–26(–30) mm, dull bluish-purple suffused with yellow at the base, or rarely pale lilac, erecto-patent or inflected, patent distally, about twice as long as calyx; tube constricted just below middle; upper lip of two sub-acute lobes recurved; lower lip of three sub-equal lobes ovate-elliptical, rounded to apiculate. Stamens inserted 5–8 mm above base of corolla, just below constriction; filaments glabrous to subglabrous; anthers glabrous, or rarely sparsely hairy at base and along sutures. Stigma white or pale blue. Flowering end of May until August. 2n=24. Native, parasitic on *Achillea millefolium*.

This native plant has a long history in Britain, if we accept John Goodyer's 1621 Hampshire record (Ray 1689: 174), but this has also been ascribed to *Limodorum abortivum* and *Epipactis purpurata*! However, we believe it is fairly certain he found *Orobanche purpurea* since the location and ecology favour this interpretation. It was subsequently recorded from Norfolk in 1779 (Petch & Swann 1968: 194), Suffolk in 1828 (Simpson 1982: 304) and collected on the Isle of Wight in 1841 by Bromfield (Bevis, Kettell & Shepard (1978) give the first record erroneously as 1846). It was found on the Channel Isles in 1839 (Marquand 1901) and it is there that most botanists of the period saw it.

Orobanche purpurea has been confused with the introduced *O. ramosa* and with the purplish forms of *O. minor*. This species has also been known as *O. caerulea* Vill., but *O. purpurea* Jacq. has priority. Confusion has occurred in the past with *O. arenaria* Borkh. from north-eastern France and Central Russia southwards to southern Spain and the Mediterranean, but this is a parasite of *Artemisia*, with hairy anthers, larger flowers and a different pigmentation. Material from Braye Bay, Alderney has, in some cases, sparsely hairy anthers and this could account for the mistake. It is interesting to note that the two extant populations in Guernsey have atypical colouration, i.e. they have yellow stems with lilac flowers, and thus more closely resemble *O. arenaria*.

Orobanche purpurea has always been found on *Achillea millefolium* in this country, generally on cliff-tops, or near the sea, although inland pasture sites have been known, e.g. Hoddesdon, Hertfordshire and the extant locality at Stoke in Hampshire. A summary of its distribution is given in Fig. 9.

This is a declining species, having become extinct in many of its British sites, although a new record has recently been reported near Senhouse Dock, Maryport, Cumbria by Milne (1986: 191). It is threatened by natural and human erosion and by land use changes. It has certainly declined on

the Isle of Wight, where it is more or less restricted to the Sandown area, due to over-collection which may have played a part in its demise elsewhere.

Reports of the occurrence of the plant in Cornwall have been rejected by Margetts & David (1981: 228), yet a specimen exists in **BM** (*Yackle*). The Kent station was on a disused allotment near Bishopsbourne (*Brooke*, **BM**). This small colony persisted for three years after the initial record was made. The Somerset record in the Red Data Book (Perring & Farrell 1983) is, we believe, incorrect. The Dorset record cited by Good (1984) may be correct, but we have seen no specimens, and are somewhat dubious. The plant is now apparently extinct in the Tenby area, from Chepstow and Hoddesdon, Hertfordshire. In the last site it was known from 1839 until about 1940. The plant is still extant in the Isle of Wight, having been recorded from nine stations. It is now reduced to four stations, one with a single plant in 1976 (Bevis, Kettell & Shepard 1978). In Hampshire the plant was found in a new locality in 1976 by the Rev. P. J. Chandler in a paddock at Stoke (Lady Anne Brewis, pers. comm.) where it still appears intermittently. It has also appeared on a nearby lawn. The local landowner attempts to conserve it, protecting it from hungry ponies, who seem partial to it! A specimen at **CGE** (20.6.1903, *Shedfield*) but with no other details represents the only other Hampshire record. In Norfolk the plant has eight comparatively recent localities, but is not now present in all of these. Cliff–falls would seem to be the main threat to survival. It has always been sporadic and local here, but these are still the best British, non Channel Islands populations. In Lincolnshire the plant was first discovered near a grain elevator in the Immingham Docks in 1929, and was still present in 1938 when it was dismissed as a grain alien (E. J. Gibbons, pers. comm.). However, it was rediscovered nearby in 1972 at the clay pit, Eastfield Road, N. Killingholme, growing with *O. minor*. This site is now a municipal tip. Large clumps of Yarrow were thus transplanted to a new site at the edge of the pit, provided by Conoco Ltd and elsewhere. Some of these transplants flowered in 1983. The remaining plants, which are marked and deliberately left will no doubt not survive. The new Cumbrian locality is also associated with railway lines within dockland and *O. minor* is present nearby near the northernmost extension of its range, perhaps suggesting a shared recent introduction.

The sorry decline of this species has resulted in it being given the N.C.C. category 8V; its populations are now monitored. Two stations are now present within local trust reserves and two more sites are S.S.S.I.s.

J. Scott managed to germinate seed of this species and, although it persisted for several years, it did not flower (J. Scott, pers. comm.). As transplants have proved successful it is likely that the plant may on occasion act as a short-lived perennial, but it is probably often monocarpic.

4. **O. rapum-genistae** Thuill., *Fl. Paris*, 2nd ed., 317 (1800).
O. major L., *Sp. Pl.* 632 (1753), pro parte.
O. rapum auct.

English names: Greater Broomrape, Broomrape.

Illustrations: Figs 2D, 5D. Photographs in Bichard & McClintock (1975: pl. 50 & dust jacket), Polunin (1969: pl. 131); drawings by Martin (1965: pl. 66), Ross-Craig (1966: pl. 23), Garrard & Streeter (1983: 150).

Perennial. Flowering stem simple, 20–90 cm, glandular-hairy, yellowish-red tinged, usually strongly swollen at base. Inflorescence rather dense, laxer below, extending over most of the shoot; lowest flowers well-separated. Bracts 15–30 mm, linear-lanceolate. Calyx 8–15 mm, each lip usually equally bifid. Corolla 20–25 mm, pale yellow to reddish outside, more strongly red inside, sub-erect to erecto-patent, campanulate; upper lip almost entire with spreading margins, lower lip with the middle lobe largest, all lobes ciliate; back of corolla curved throughout, glandular pubescent. Stamens inserted not more than 2 mm above base; filaments glabrous below, glandular-pubescent above. Style glandular-pubescent; stigma lobes yellow, distant. Flowering period May to early August. Visited by bees. n=19*. Native, parasitic on shrubby Leguminosae.

Identification of the plant is usually straight forward, although in some respects its common name is misleading, as *O. elatior* is often a taller plant. *Orobanche rapum-genistae* is usually stouter, with larger flowers and has a different colouration, being red-brown rather than yellowish-brown. The specific name means literally Turnip of Broom, a reference to the usually swollen base, and is not, as might be expected, an allusion to its 'shameful' life style. This species is the most obviously perennial of those found in Britain, the dead spikes being found next to those of the current year. This enables the plant to persist, even when the locality is unfavourably disturbed. However, if the host is destroyed, as happened in Bedfordshire and Hertfordshire in the severe winter of 1962/3, then the colony may be lost.

This species was at one time the most widespread and frequently encountered species of *Orobanche* in Britain. It was confused with *O. elatior* (for discussion on this see under *O. elatior*) and *O. caryophyllacea*. Unfortunately, this species has undergone a remarkable decline, for reasons which are not yet apparent. In the middle of the last century it was found in over 25 vice-counties, extending as far north as Dumfriesshire. By 1930 its range had not changed markedly, but the number of stations had dramatically decreased. This decline has continued into the 1970s, but may now have stabilized. The plant is probably now extant in c. 20 vice-counties, but in many it is restricted to a single site where its continued existence must be considered precarious. A summary of its distribution is given in Fig. 10.

The plant can persist for longer periods; thus, it was first recorded in Lincolnshire at its sole locality in 1894 and, in spite of applications of weedkiller and the area being used as a caravan site, it probably still persists. Recent records were made in 1978 (nine plants), 1980 ("2 clumps") and 1983 (three plants) (E. J. Gibbons, pers. comm.). In Sussex the plant is also reduced to a single station with a critically low population size. In 1983, two plants were all that remained after its host was largely grubbed out to open a trackway (L. B. Burt pers. comm.). The 1983 find in Norfolk (Plant Records in *Watsonia* **15**: 136, 1984), the first for over 60 years, suggests careful search may reveal this plant in more localities and vice-counties. A thriving population was recorded from N. Essex in the mid-1960s (Jermyn 1974: 146), and may still be extant, but its exact location is unknown to the vice-county recorder (K. J. Adams, pers. comm.). In Ireland, where the plant was first recorded in 1727, it now seems restricted to Co. Cork, Co. Waterford, Co. Wexford and Co. Wicklow, and, while never common, it was present in three other vice-counties and it has decreased quite markedly both in number and size of populations, and had thus been accorded 'protected' status. The plant is also tolerably plentiful on sea cliffs in Jersey and Alderney where it parasitizes *Cytisus scoparius* subsp. *maritimus*. In most British localities it preferred *Cytisus scoparius* subsp. *scoparius*, but many records exist for *Ulex europaeus*, and indeed, this is favoured in its Irish sites. A series of plants was collected in Kent in 1837 on *Genista tinctoria* (*Stevens*, **BM**), but these are the only specimens recorded for this host that we have found. A 1968 sighting on Broad Beans in a Herefordshire garden was probably the introduced *O. crenata*. As most counties still have adequate populations of *Ulex europaeus* and *Cytisus scoparius* it is probable that the decline is due to some other reason. The species is now restricted to the mildest parts of Britain, being predominantly south-western and coastal, and thus the climate may be suspected as being involved in its demise. Evidence for a climatic change corresponding to the time of extinction of most colonies is provided by the behaviour of other more mediterranean elements in our flora. However, the decline has been exacerbated by the destruction of many of our larger stands of shrubby legumes. *Orobanche rapum-genistae* seems to occur only where the host is frequent. Many promising host colonies now exist on motorway banks and along railways, and it is to be hoped that the plant will recolonise such areas.

5. **O. alba** Stephan ex Willd., *Sp. Pl.* **3**: 350 (1800).
O. rubra Sm., *English Botany*, t. 1786 (1805).
O. epithymum DC., *Fl. franc.* **3**: 490 (1805).

English names: Thyme Broomrape, Red Broomrape.

Illustrations: Figs 1D, 4D. Photographs in Polunin, (1980: pl. 47), Rosvall (1979a: 37, Fig. 3B & E, & journal cover); drawings in Martin (1965: pl. 66), Ross-Craig (1966: pl. 26), Butcher (1961, **2**: 285), Garrard & Streeter (1983: 149).

Flowering stems simple, usually 8–25 cm (occasionally to 45 cm in European specimens), dark orange-red, glandular-pubescent, slightly swollen at base. Inflorescence dense to lax, flowers usually few. Bracts 12–25 mm, lanceolate, acuminate, glandular, equal in length to the corolla. Calyx 8–16 mm usually entire, occasionally bidentate. Corolla 15–25 mm, pale cream usually strongly suffused reddish-purple, glandular-pubescent especially distally, erecto-patent, slightly curved, more strongly so at the basal and distal ends; tube campanulate-cylindrical; upper lip entire or 2-lobed; lower lip glandular-ciliate, the 3 lobes about equal, the middle just the largest. Stamens inserted 1–3 mm above the base of the corolla; filaments hairy below, glandular above. Stigma red or purplish, the lobes joined. Flowering period late May to early September. Flowers fragrant, visited by bumble-bees. 2n=38. Native, parasitic on *Thymus*.

This species was described from Cave Hill, Belfast, Ireland by J. E. Smith in Sowerby (1805, t. 1786) under the name of *Orobanche rubra* Sm. from material sent by J. E. Templeton (**LINN**). It was not until much later that the British and Irish plants were identified as being merely a colour variant of the continental *Orobanche alba* Stephan ex Willd. The plant was not found in Cornwall until 1842, when the Lizard Peninsula became a botanical mecca. It has only been found parasitizing *Thymus* in Britain and Ireland; records from other hosts have, in all cases, proved to be *Orobanche minor*. Rosvall (1979b) records it on *Thymus serpyllum* in Gotland. The plant when fresh is completely unmistakable, having a scent likened by J. Templeton to that of *Lonicera grata*, and a striking red colour. Large herbarium specimens are sometimes incorrectly determined as *Orobanche hederae* or *Orobanche minor*. They may be told apart by the distinct glands on the corolla, the shape and venation of the calyx teeth (compare Figs 4D, 6C & 7D) and by the characteristic shiny red-brown colour of the *O. alba* pressed plants.

The plant has undoubtedly declined somewhat in the British Isles. A summary of its distribution is given in Fig. 11. It is now believed absent from the east coast of Britain. The Lincolnshire station was possibly based on a misidentification, but its disappearance from Fife is more worrying, although careful searches here may yet reveal the plant to be still extant. In Cornwall its range has decreased, and it is now virtually restricted to the Lizard; elsewhere it was always very rare. Many of the Scottish populations have not been re-examined lately, but we should expect to find no real decline, since new stations are being discovered compensating for populations which have become extinct. Many of the remaining populations are undoubtedly very large, or perhaps it would be more accurate to say, have the potential to be very large. The plants are annuals, or possibly monocarpic and rely on good seed production and an adequate supply of the host, both features which can fluctuate from year to year, and it is therefore difficult to accurately assess population sizes. Thus, the plant is not threatened with extinction in Britain, unlike many of its close relatives. Collection in the past has probably not helped the plant, and may have caused its loss from some better known areas. Examination of herbarium material shows that collectors considered that to adequately fill a sheet many plants were needed! The Lizard population at Kynance certainly has survived this onslaught remarkably well. The habitat of the plants, on coastal rocky slopes, usually basalt, but sometimes serpentine, and in the Burren, Ireland, on limestone, is unlikely to be built upon. The only danger to the plant is erosion of cliffs, both by natural means, and by the increasing number of walkers around our coasts.

6. **O. reticulata** Wallr., *Orob. Gen.* 42 (1825).
O. pallidiflora Wimmer & Graeb., *Fl. siles.* **2**: 1 (1829).

English name: Thistle Broomrape.

Illustrations: Figs 1E, 5A. Photographs in Lousley (1950): pl. 17), Sitwell (1984: 37); drawings in Ross-Craig (1966: pl. 27), Butcher (1961, **2**: 288) Garrard & Streeter (1983: 149).

Flowering stem simple, 15–70 cm, glandular-hairy, tinged yellowish-purple, slightly swollen below. Inflorescence rather dense, laxer below, often occupying most of the stem, the lowest flowers often well-separated. Bracts 12–25 mm, narrowly triangular equal to, to shortly exceeding corolla. Calyx 7–12 mm, bifid, upper segment largest. Corolla 12–22 mm, tinged creamy-yellowish, purple distally,

strongest around the margins, broadly cylindrical-campanulate, with dark glands, especially distally; upper lip with spreading lobes, lower with 3 equal lobes, the middle squarish. Stamens inserted 2–4 mm above the base of the corolla; filaments glabrous to sparsely hairy below, somewhat glandular to glabrous above. Stigma lobes purple, just touching at base. Flowering period June to August. Native, parasitic on thistles.

This rare British native was first reported in 1908, although the plant had been collected at a well-known locality in Mid-W. Yorks. as early as 1881 (*Webster*, **BM**). There is an earlier specimen, dated 1835, from "Notts." mistakenly identified as *O. major* by a collector whose material is of dubious provenance (*Cooper* in herb. H.C. Watson, **K**). The magnesian limestone does extend into this area and the past existence of *O. reticulata* in v.c. 56 is not improbable. A specimen from James Backhouse's Nursery, parasitic on *Cirsium heterophyllum* All. was collected in 1886, originating possibly by wind blown seed from the nearby native sites (*Backhouse*, **K**). At first, doubts as to the status of this species were expressed; certainly, its distribution is unique amongst British plants and is somewhat linked to roman roads and settlements (Fig. 12); however its European distribution lends plausibility to its consideration as a native species.

The plant has been found in fewer than ten localities, all on the magnesian limestone in north-western Yorkshire. However, early records of *O. major* and *O. minor* from other stations within the *O. reticulata* range are suspect and may indicate a greater abundance in the past. The usual hosts are *Cirsium arvense* L. and *C. eriophorum* Scop., but other thistles may be parasitized. The habitats include: unimproved pasture, roadsides, waste places and grassland overlying limestone.

The species has been reported in error from Falmouth Docks, Cornwall in 1917 and from near Llandowey in 1905 by H. H. Knight. The Cornish plant was *O. minor*, and the Welsh one determined *O. reticulata* var. *procera* (W. D. Koch) G. Beck by Beck, but later as *O. picridis* Schultz (= *O. loricata* Reichenb.) by Graham and Melderis. The specimen more closely approaches the latter, and is certainly not *O. reticulata*. This specimen is responsible for Druce's addition of var. *pallidiflora* (Wimm. & Graebner) Beck to the British list. He is believed to have mis-read Beck's determination, sent on a postcard written in German. Pugsley (1940) deleted this variety, but it was resurrected at subspecific rank by Clapham (1952). The chief distinctions given are the glandulosity of the filaments, degree of pigmentation and differences in host range. Webb & Chater (1972) do not recognise any subspecies in *Flora Europaea*, and study of the British material supports this view. The full range of corolla pigmentation shown by this species is seen within our restricted gene pool, although individual populations are quite uniform. Host range can only be satisfactorily tested by cultivation experiments, and without associated morphological differences is impractical for traditional taxonomic recognition.

The plant is at least rarely perennial (Branson, 28/7/1956, **E**), and numbers fluctuate widely at its few British sites. It has been suggested that the plant is in decline, but little evidence for this exists. Such rumours are based on the sporadic flowering, e.g. at one station the following counts have been made: 1939 – 400+, 1966 – 1, 1967 – 6, 1987 – 100+, and at another: 1984 – 26, 1985 – 42, 1986 – 1, 1987 – 1000+. In most years each of the populations produce between none and 25 flower spikes, and so its future is precarious. Sites are endangered by changes in land use: ploughing, spraying, dumping, gravel working and road widening. The plant is present in at least one S.S.S.I., in a Yorkshire Wildlife Trust reserve, and it was planned to introduce it into another. It is given an 11E rating by Perring & Farrell (1983) and is fully protected by the law. As its hosts are scheduled weeds, a legal dilemma is possible!

7. **O. caryophyllacea** Sm. in *Trans Linn. Soc. Lond.* **4**: 169 (1797).
O. vulgaris Poiret in Lam., *Encyclop.* **4**: 621 (1797).

English names: Clove-scented Broomrape, Bedstraw Broomrape.

Illustrations: Figs 1F, 5B. Photographs in Huxley & Taylor (1977: pl. 271); Sitwell (1984: 35); drawings in Ross-Craig (1966: pl. 24), Butcher (1961, 2: 286), Martin (1965: pl. 66), Garrard & Streeter (1983: 150).

Flowering stem 15–40(–50) cm, simple, glandular-hairy, whitish, pale yellow or pale pink in colour with numerous to few flowers in a rather lax spike smelling quite strongly of cloves, especially in

warm weather. Bracts 17–25 mm, ovate-lanceolate, acuminate, more or less equal to the corolla. Calyx 10–17 mm, entire to ±equally bifid. Corolla 20–32 mm, same colour as stem, glandular pubescent, erecto-patent, campanulate, broadest just behind mouth, ±uniformly curved, upper lip emarginate, lower lip with subequal glandular-ciliate almost fimbriate lobes. Stamens inserted 1–3 mm above the base of the corolla tube, filaments hairy below, glandular above. Stigma dark purple, lobes distant. Flowering period mid-May to late July. Visited and pollinated by bumble-bees. $2n=38$. Native, parasitic on Rubiaceae.

This species may be known when fresh, by its large, pale-coloured flowers with a strong, fragrant scent. In dried specimens the mid-brown, non-shiny flowers, which are rather hairy and of characteristic shape, combined with a dark stigma, make the plant unmistakable.

The plant was discovered in several stations in the Folkestone and Dover area by the Rev. Gerard Smith in May 1830. It has not markedly declined in general range in this area, but some populations have undoubtedly been lost, and others have dwindled; a roadside verge site has recently been lost through road widening (Perring & Farrell 1983) who also state: ". . . only two stations are now known, neither with large populations". This is contrary to information in Philp (1982). The plant is undoubtedly very rare, having been assigned an N.C.C. threat number of 12E, but is now fully protected under the Wildlife and Countryside Act of 1981. Two Kent populations are protected in S.S.S.I.s. A summary of its distribution is given in Fig. 13.

Several sources have perpetuated the myth that the plant is only found on *Galium mollugo* L. in Britain. The population near Sandwich, which in a good year may number over 100 specimens, is found mainly on *Galium verum* L. Plants from other Kentish localities have also been found on *G. verum*. Milne-Redhead (1985) has introduced the plant to the natural order beds at the Royal Botanic Gardens, Kew, where it persists on several genera of the Rubiaceae.

Two main types of habitat are preferred by this species: stabilized sand dunes, as at Deal and Sandwich, and hedgebanks and scrub, as at the base of the chalk downs and undercliff in the Dover area.

It is suggested by some that these British populations, being found at this south-eastern extremity of Britain, where the Channel is narrowest, is the result of wind-blown seed from France. It seems strange that the plant has not spread further over the chalk in southern England, once it had its foot in the English door. The distribution would suggest an environmental reason for its restricted range, yet the plant is found in Scandinavia and the Alps.

Orobanche caryophyllacea has been reported by Simpson (1982) as occurring in Suffolk in 1940, when it was recorded by C.C.T. Giles parasitic on *Galium verum*, but we have seen no specimens and suspect confusion with another species. A specimen exists in H. C. Watson's herbarium at **K**, labelled as "*O. leucorum*?" and said to have been gathered in Surrey in 1846. This herbarium also contains the specimens on which is based the single enigmatic record from the Scottish Highlands, with a duplicate in the main herbarium at **K**. Originally identified as "*O. major*?" or "*O. elatior*", these three specimens were collected in 1844 in the Loch Nell area by E. Harvey. This same collector had given H. C. Watson another specimen of *O. caryophyllacea* labelled as *O. rapum-genistae* from near Oakwood, Dumfries, and so considerable suspicion must be attached to the provenance of these specimens. Further Victorian specimens of this species from North Wales have been reported by Rumsey (1985), although it seems most likely that these resulted from confusion of labels or mixing of specimens during mounting.

The decline of this always rare species can be explained partly through habitat destruction, but over-collecting must in this case have had some effect for there are over 115 plants gathered from Kent in **BM** alone! Other than the preservation of localities and the maintaining of conditions for the host plant, it seems difficult to see how this usually annual species may be conserved effectively.

8. **O. elatior** Sutton in *Trans. Linn. Soc. Lond.* **4**: 178 (1797).
O. major L., pro parte.

English name: Tall Broomrape.

Illustrations: Figs 2A, 5C. Photographs in Strid (1980: pl. 63), Petch & Swann (1968: pl. 73); drawings in Garrard & Streeter (1983: 150), Ross-Craig (1966: pl. 25), Butcher (1961: 287), Martin (1965: pl. 66).

Flowering stem simple, (15–)25–70 cm, usually stout, yellowish to orange, often with a rather bulbous base, usually glandular pubescent. Flowers numerous, usually densely packed, often confined to the top third of the stem. Bracts 15–25 mm, lanceolate, acuminate. Calyx (6–)9–11 mm, segments connate at base, usually unequally bidentate. Corolla 18–25 mm, yellow or orange with reddish-brown veins; uniformly curved throughout, widely tubular, glandular-pubescent, sub-erect to erecto-patent, sometimes patent; upper lip ± entire, or more often two-lobed, usually spreading; lower lip three-lobed, the lobes nearly equal, crisped, denticulate. Stamens inserted 3–6 mm above the base of the corolla tube; filaments hairy below, glandular throughout. Stigma lobes yellow. Flowering period mid-June to August. 2n=38. Native, usually parasitic on *Centaurea*.

This plant was described by Sutton (1797), but has been the centre of a taxonomic wrangle causing a great deal of confusion. This stems from the inadequate description of *O. major*, together with a confusing array of synonyms. *Orobanche major* has been interpreted to include *O. elatior*, *O. rapum-genistae* and larger specimens of *O. minor*! British and French botanists used the name *O. major* for *Orobanche rapum-genistae*, while Beck-Mannagetta (1930) assigned *Orobanche elatior* to this, citing Linnaeus's *Flora Suecica* of 1755; *O. elatior* is a Swedish plant, while *O. rapum-genistae* is not. However, in the second edition of his *Species Plantarum*, Linnaeus (1763) states clearly that the plant grows on the roots of Leguminosae. Linnaeus did not understand *Orobanche* at all well! There is a sheet in **LINN** on which two specimens are mounted, these having been sent to Linnaeus by Loefling, and were inscribed "*Orobanche major*" by Linnaeus. Sir James Smith saw these and annotated the sheet "*minor* Mr. Sutton". Later, Hooker was to claim no sheet of *Orobanche major* existed in the herbarium. Pugsley examined the sheet and considered the plants most like *Orobanche picridis*. He hoped that the specific identity of the plants could be established, so that *O. major* L. could be validated. We have examined the sheet and believe the two specimens belong to different species. The left, which has been attacked by beetles, does indeed look quite like *O. picridis*; however, we do not believe it is. We consider it is probably a pale form of *Orobanche crenata* Forskål, a plant which would be found in the area Loefling collected from. The flowers are 20–25 mm with straight backs and erect upper lips. The right hand plant suggests *O. elatior*, but examination of an opened corolla of this plant showed a stamen insertion of 2–4 mm and glabrous filaments. Such a combination of characters seems to rule out *Orobanche elatior*. Because of this, and the overall confusion, it would seem necessary to reject the name *O. major* L.

In Britain, *Orobanche elatior* grows almost exclusively on *Centaurea scabiosa* L., but it has been reported on *Centaurea nigra* L. The habitat preference of the host largely determines the parasite's distribution but *O. elatior* is more restricted to chalk and Jurassic limestones. Early authors stated that this plant grows on *Trifolium pratense* L. Confusion with large states of *O. minor* is probable in many cases. Where the plant is correctly identified, it is probable that the wrong host was given as it is often difficult to trace the root systems.

The plant grows on chalk downs, in disused chalk pits, on roadsides, etc. It is a perennial and may throw up a large clump of flower spikes from a single host. The previous year's flower spikes often persist and may be found next to the new spikes. The plant is of a characteristic colour with a yellowish stem, and usually pinkish- to yellowish-brown flowers; however, f. *citrina* (Druce) Pugsley has the whole plant citron yellow. The plant may be confused when small with *O. minor*, but only var. *compositarum* has the suberect corollas so often found in *O. elatior*. The flowers are broader in *O. elatior*, have conspicuous brown veins and are more glandular, while the whole plant has a distinctly different look about it, difficult to describe. This species is somewhat local and many of its sites would be threatened by land-use changes. It is still tolerably plentiful, especially in Wiltshire and northern Essex/Cambridgeshire. However, it is decreasing towards the western and northern extremities of its range, possibly for climatic reasons. A summary of its distribution is given in Fig. 14.

9. **O. loricata** Reichenb., *Pl. Crit.* **7**: 41 (1829).
O. picridis F. W. Schultz ex Koch, *Fl Deutsch.* **4**: 453 (1833).

English names: Oxtongue Broomrape, Picris Broomrape.

Illustrations: Figs 3A, 6A. Drawings in Ross-Craig (1966: pl. 30 as *O. picridis*), Garrard & Streeter (1983: 149), Butcher (1961: 290 as *O. picridis*). The illustration in Sitwell (1984) purporting to be this species is in fact *O. minor* var. *maritima*.

Flowering stems simple, (10–)20–60 cm, glandular-pubescent to subglabrous, pale yellowish, often with a purple tinge. Inflorescence rather dense, flowers usually restricted to top half of stem. Bracts 12–20 mm, narrowly ovate-acuminate, equalling to just exceeding the flowers. Calyx 10–15 mm, segments unequally bifid, rarely entire; the segments slender, acuminate, 1-veined or 3-veined, the outer veins very indistinct. Corolla 14–22 mm, very pale, ivory to yellowish, veined purple-lilac distally, glandular-pubescent to subglabrous, upper lip emarginate to bifid, porrect to erect, ± forming a standard; lobes of lower lip subequal, or the middle the largest, squarish in shape; all lobes crisped and denticulate; back of corolla curved at base, then ± straight. Stamens inserted (2–) 3–5 mm above the base of corolla; filaments with conspicuous white hairs below. Stigma purple, lobes just touching. Flowering period June to July. 2n = c. 38* & 38. Native and introduced, often parasitic on Compositae but not exclusively.

This species is very clearly related to the widespread *O. minor*, and all the diagnostic characters overlap with the extremes found in that species. Seeds identical to those of *Orobanche minor*. Intermediates are not uncommon and may represent hybrids. Some herbarium specimens cannot be assigned to either species with certainty. The distinctions are much clearer in fresh material. In typical material the very pale colour is distinctive. This paleness is also apparent in herbarium specimens, which often have a characteristic orange-brown colour. The calyx lobes are long and thin, the upper segment with one conspicuous vein only. The bracts more or less exceed the flowers and may be very apparent at the top of the spike. The stigma lobes become very dark on drying, contrasting very strongly with the pale corollas. The bracts and stem of *O. loricata* are more pubescent than is usual in *O. minor* and the filaments, which are inserted rather higher, are covered below in long white hairs. The porrect to suberect upper lip of the corolla is also a useful taxonomic character, but is not always present.

We have seen specimens of this species from seven vice-counties: Wight, Kent, Surrey, Bucks., Cambs., Gloucs. and Pembs. A summary of its distribution, based on material we have seen, is given in Fig. 15. D. J. Hambler has determined an 1892 specimen from Guernsey as this species, and also a more recent record from Brean Down, Somerset. We have examined the voucher material for this latter record and believe it to be slightly atypical material of *O. hederae*, which is abundant in this area.

An earlier Somerset record, determined by Beck, has also been queried (Roe 1981). The specimens from Surrey, Buckinghamshire and Gloucestershire more closely approach *O. minor* in stature and pigmentation. *O. loricata* was first recognised as British in 1848 by C. C. Babington who discovered it growing in the Comberton area of Cambridgeshire. It was last seen in this general vicinity, at Haslingfield in 1935. Babington was also to discover the plant later the same year in a quarry on Giltar Point, Pembrokeshire, where it was still present in 1851 but has not been seen since. Earlier specimens exist from the two best known and still extant locations: near Freshwater, Isle of Wight and St Margarets, Kent. The former had become completely inaccessible through coastal erosion and had not been seen for many years (Bevis, Kettell & Shepard 1978), but a small colony has appeared on the cliff top in recent years and plants can be seen on the ledges below. Similarly the St Margarets site is largely inaccessible, with plants scattered on cliff ledges and unstable chalky debris. *O. loricata* also sporadically occurs at a second Kent locality, near Dover, where less than five spikes are to be found in most years. These sites are all on unstable steep chalk cliffs where the usual host is *Picris hieracioides*, but at St Margarets, *Pilosella officinarum* is also parasitized. A further site was discovered by chance when photographs of an unnamed broomrape were exhibited at the 1984 B.S.B.I. exhibition meeting by Mr V. Johnstone. These were of a group of *O. loricata* parasitizing a *Crepis* sp. on the R. Adur flood plain in W. Sussex. However, a subsequent visit by D. C. Lang revealed only *O. minor* at the site.

O. loricata is probably Britain's least understood and rarest, in terms of plant numbers, broomrape and this has been recognised by its inclusion in the 1981 Wildlife and Countryside Act. Inaccessibility accords it some protection though population sizes fluctuate due to natural changes in its unstable habitat.

10. **O. minor** Sm., *Eng. Bot.* **6**: 422 (1797).
O. minor Sutton in *Trans. Linn. Soc. Lond.* **4**: 179 (1797).

English names: Common Broomrape, Lesser Broomrape.

Illustrations: Figs 3B–E, 6G, D, 7A–B. Photographs in Polunin (1969: pl. 131), Gilmour & Walters (1954: pl. 22), Philp (1982: 196 as *O. amethystea*); drawings in Martin (1965: pl. 66), Garrard & Streeter (1983: 149), Butcher (1961, **2**: 289).

Flowering stems simple, (5–)10–60 cm, glandular-puberulent to hairy, yellow or reddish-brown variously tinged purple. Spike lax to dense. Bracts 6–22 mm ovate-lanceolate to lanceolate-subulate, acuminate, ± equalling to just exceeding the corolla. Calyx 6–14 mm long equally to unequally bifid or entire. Corolla 10–18 mm, creamy-yellow, curved regularly throughout or sharply inflected at the base then curved, purplish suffused to a variable extent, glandular- pubescent to ± glabrous, upper lip emarginate or slightly bilobed with the lobes directed forwards; lobes of lower lip sub-equal or with the central the largest, all lobes crisped and denticulate. Stamens inserted 2–3.5 mm above the corolla base; filaments glabrous to sparsely hairy below. Stigma lobes yellow or reddish-purple, just touching at base to partially united. Flowering period late May to mid September. n = 19, 2n = 38. Probably native but frequently introduced, a parasite of many families.

Undoubtedly our most common broomrape, which makes its date of description all the more remarkable. It is likely that the early English botanists confused this species with many of the other members of the genus but even allowing for such confusion it would seem to have greatly increased in this country, probably through repeated introduction with fodder crops. Cleaner seed and changes in agricultural practice would seem to have caused some decline. Webb (1985) has questioned the native status of this species in the British Isles; it is unquestionably an introduction in Ireland where it occupies similar habitats. Its indigenous range is now unclear through man's activities. *O. minor* exemplifies the taxonomic difficulties posed by the genus. As with many parasitic groups, morphological reduction has deprived the taxonomist of diagnostic characters. This, when combined with the largely unknown host-determined effects on parasitic morphology and phenology, makes classification problematic. Seeds similar to those of *O. elatior*, with few 'cells' on the surface. Seed size and shape are very variable and are not of use in distinguishing the infraspecific taxa in the *O. minor* agg. Of all the *Orobanche* species *O. minor* has the most catholic tastes with regard to hosts, hundreds of species in families from the Ranunculaceae to the Gramineae are attacked but a clear preference is shown for the Leguminosae and Compositae. Cultivation experiments which could determine the influence of the host and degree of host specificity are difficult to perform. Musselmann & Parker (1982) have shown that races of *O. minor* physiologically adapted to certain hosts exist and it is easy to visualise speciation progressing along these lines. *O. minor* has efficient seed dispersal and is largely inbreeding; accordingly populations preferentially parasitizing a species which has its own distinct ecological preferences may become effectively isolated and ultimately give rise to distinct taxa. Recognition of these by traditional means is only possible where subtle morphological differences have paralleled the more profound but invisible physiological changes; such morphological characters may be of lesser selective importance. As so little is known of the cytology and physiology of *O. minor* sensu lato, the following treatment is perhaps best regarded as provisional. We conclude it best to regard *O. minor* in Britain and Ireland as consisting of four varieties which can be distinguished as follows.

Key to the varieties of *Orobanche minor*:

1. Plant yellow*, to 25 cm, rarely more, spike dense almost sub-globose. Stigma lobes yellow. Host usually *Hypochaeris radicata* ..... 10c. var. *flava*
1. Plant purple*, to 60 cm, spike lax to dense above. Stigma lobes reddish brown to purple. Hosts various 2
2. Flowers sub-erect at anthesis, slender, ca 3.5–5.0 mm diameter, pale, sub-glabrous. Hosts usually *Crepis* spp. and other Compositae ..... 10b. var. *compositarum*
2. Flowers patent to erecto-patent, ca 5.0–8.0 mm diameter, ± suffused purple, glandular

pubescent to sub-glabrous. Hosts various 3

3. Plant with bulbous base, stem glandular-puberulent, to 35 cm. Bracts not exceeding corolla. Calyx short, 6–10 mm, usually entire. Lower lip with middle lobe the largest, reniform. Stigma lobes partially fused. Host almost exclusively *Daucus carota* subsp. *gummifer* .... 10d. var. *maritima*

3. Plant usually without 'bulb' at base, stem sub-glabrous to glandular-pubescent to 60 cm. Bracts equalling to exceeding corolla. Calyx ca 7.5–16 mm, bifid or entire. Lower lip with sub-equal broadly rounded lobes. Stigma lobes scarcely fused becoming distant with age. Hosts various ..... 10a. var. *minor*

* Rarely individuals without purple pigmentation but otherwise identical to var. *minor* occur, to which they are best referred. Similar pigment-less variants exist in other *Orobanche* species, e.g. *O. hederae*, *O. elatior* and *O. crenata*.

10a. var. **minor**

Illustrations: Figs 3B, 6C.

Flowering stems (5–)10–60 cm, glandular-pubescent, reddish-brown tinged purple, rarely yellow. Spike usually lax below ± dense above. Bracts 7–22 mm ovate-lanceolate equalling or exceeding the corollas. Calyx 7–14 mm equally or unequally bifid or entire. Corolla 10–18 mm glandular pubescent to sub-glabrous, back ± regularly curved; upper lip emarginate to bilobed, forwardly directed rarely ± sub-erect; lower lip with sub-equal lobes, all crisped and denticulate. Filaments glabrous to sparsely hairy below inserted 2–3.5 mm above corolla base. Stigma lobes purplish, touching at base becoming more distant with age. Flowering period late May to mid September. 2n = 38*.

A highly variable and widespread plant, possibly not native. Its appearances are often casual or sporadic. Most commonly encountered on roadsides, in disused chalk and gravel pits and on 'grey' dunes in coastal areas. It is becoming increasingly common as a weed in flowerbeds where the usual hosts are shrubby *Senecio* spp. A summary of its distribution (based on all records of the species, other than those attributed to the rarer varieties) is given in Fig. 16.

We include in this taxon the plants referred to the Mediterranean species *O. amethystea* Thuill. by Philp (1982). Some of the Kent plants do approach this in some respects but *O. amethystea* has larger flowers with a distinctly bilobed, sub-erect upper lip and a higher filament insertion. The population at Sandwich consists of plants parasitic on a wide range of hosts, including *Eryngium maritimum*, *Ononis repens*, *Calystegia soldanella*, *Honkenya peploides* and *Elymus farctus*. The host influence on stature and pigmentation is apparent and a full range of intermediates between *O. amethystea sensu* Philp and typical *O. minor* can readily be found.

Occasional pigment-less variants are found, indeed the type sheet at **LINN** contains just such, as well as pigmented, material. We prefer not to treat the albino variant at varietal rank as it differs only in this respect and lacks the distinct morphological features, ecology and distribution shown by var. *flava* E. Regel.

10b. var. **compositarum** Pugsley in *J. Bot., Lond.* **78**: 111 (1940).

Illustrations: Figs 3C, 6D.

Flowering stems 10–50 cm glandular pubescent to sub-glabrous, usually pale reddish-brown. Spike ± lax throughout. Bracts and calyx as in var. *minor*. Corolla 10–18 mm slenderer than in var. *minor*, sub-glabrous, sub-erect not horizontal at anthesis, less heavily pigmented. Other characters as var. *minor*.

A distinctive looking variant distinguished by its narrower, paler, sub-erect corollas. Pugsley (1940) claimed that the filament bases were hairier than usual for var. *minor*. This variety would appear to be thinly scattered throughout the British range of *O. minor* sensu stricto but is probably under-recorded. It would seem to be most frequent on sandy soils in Surrey, East Anglia and in coastal

areas elsewhere. Extra-British distribution is unknown. Host plants are, as the name would suggest, usually Compositae, *Crepis virens* being the most frequently recorded. Other hosts include *Hypochaeris radicata*, *Tripleurospermum inodorum*, *Carduus nutans*, *Senecio greyii* and exceptionally *Smyrnium olusatrum*. Specimens from Nob End, South Lancs., parasitic on *Trifolium pratense* are also probably best referred to this variety. Care should be taken when naming fruiting specimens as the corollas in var. *minor* may become increasingly erect with age.

10c. var. **flava** E. Regel, in Otto & Dietrich, *Allg. Gartenzeit.* 284 (1842).
O. minor Sm. var. *lutea* Tourlet in *Bull. Soc. Bot. Fr.* **1**: 421 (1903).
O. ritro Gren. & Godron f. *hypochaeroides* Beck ex Druce in *J. Bot., Lond.* **45**: 425 (1907).

Illustrations: Figs 3D, 7A.

Flowering stem 8–18(–25) cm, glandular-pubescent, yellow. Spike dense sometimes sub-globose. Bracts 6–14 mm, ovate lanceolate, equalling corollas. Calyx 6–10 mm, entire almost filiform. Corolla 10–14 mm, sparsely glandular, curved throughout but most sharply inflected at the base. Upper lip emarginate, lobes forwardly directed; lower lip with ± subequal lobes, all crisped and denticulate. Filaments sub-glabrous, inserted 3–3.5 mm above corolla base. Stigma lobes yellow touching at base. Flowering period early June to mid July.

Plants referable to this taxon were first collected in the British Isles in 1866 by Syme at St Ouens, Jersey. It has subsequently been gathered here by many botanists under a confusing array of names (Pugsley 1940). Le Sueur (1984) incorrectly treated this taxon under *O. elatior* and suggested that it was destroyed by building during the Second World War. However, there is a specimen at **LIV** dated 1951. Other sites include Braye Bay, Alderney (Pugsley 1940) and Newport Docks, Glamorgan. Similar plants were reported as growing at Grand Havre, Guernsey by Syme in Sowerby (1866).

Unfortunately we have not been able to examine the types of var. *flava* E. Regel or var. *lutea* Tourlet and it is possible that they may be based on pigment-less variants of var. *minor* and therefore not be conspecific with the distinctive Channel Islands taxon. Similar plants have not been found elsewhere on coastal dune systems, suggesting the morphological features are not an environmental modification. This taxon would appear to us to be more closely related to var. *maritima* than to var. *minor*. Its continued existence in this country is somewhat precarious, the sole extant site being by a railway line in an area of dockland.

10d. var. **maritima** (Pugsley) Rumsey & Jury in *Watsonia* **17**: 442 (1989).
O. maritima Pugsley in *J. Bot., Lond.* **78**: 110 (1940).

English name: Carrot Broomrape.

Illustrations: Figs 3E, 7B. Photograph in Sitwell (1984: 36, as *O. loricata*); drawings in Garrard & Streeter (1983: 149), Butcher (1961, **2**: 291).

Flowering stem 10–30(–40) cm, heavily pigmented with purple, glandular-puberulent, usually with a pronounced bulbous base from which several stems may arise. Flowers few to many in a dense spike. Bracts 8–16 mm, lanceolate from a broad base, usually not exceeding the corollas. Calyx 6–10 mm, entire or unequally bifid. Corolla 10–17 mm, sparsely glandular, sharply inflected at base; upper lip entire to emarginate; lower lip with middle lobe the largest, reniform, with pronounced yellowish bosses; all lobes crisped and denticulate. Filaments glabrous to sparsely hairy below, inserted 2–3 mm above the corolla base. Stigma lobes partially united, purple. Flowering period late May to early August.

This interesting variant can usually be distinguished from the widespread var. *minor* by the characters stressed in the key but these are not always easily seen in herbarium material. The squatter corollas densely packed in the top third of the spike is, however, a good indication of this exclusively maritime taxon.

O minor var. *maritima* appears to be largely restricted to steep calcareous sea cliffs, where it almost exclusively parasitizes *Daucus carota* subsp. *gummifer*, but it is occasionally found in dune grasslands.

Plants referrable to this taxon were first reported in Britain in 1845 by Rev. W. S. Hore. He collected it on the cliffs at Whitsand Bay, Cornwall and identified it as *O. amethystea* Thuill. presumably misled by its deep 'amethyst' colour. His identification was disputed and doubted by many yet the name persisted until Pugsley (1940) showed that the continental *O. amethystea* Thuill. was distinct and that our plant was of an undescribed taxon. Material sent to Beck von Mannagetta had been returned with various unsatisfactory names; Pugsley thus named the plant. Many British botanists since have questioned the distinctness of this taxon. Webb & Chater (1972) sink it completely in *O. minor* but note that it may have affinities with *O. loricata* Reichenb. We prefer to treat this taxon as a variety of *O. minor*. The morphological features distinguishing it are small and continuously variable to *O. minor* var. *minor*; this intergradation is most apparent at the eastern extremity of its range, however it has a distinct ecology and distribution and quite marked host specificity. Whereas *O. minor* var. *minor* is possibly not truly native, var. *maritima* would seem to be. Its distribution pattern (Fig. 17) closely reflects that of its chief host, the coastal ecotype of the carrot, *Daucus carota* subsp. *gummifer*, and is shared to varying degrees by a range of species including: *Lotus subbiflorus*, *L. angustissimus*, *Centaurium capitatum*, *Bromus hordeaceus* subsp. *ferronii*, *Polycarpon tetraphyllum* and *Brassica oleracea*, only the last named being of questionable status. The extra-British distribution of var. *maritima* is unclear. In his original description, Pugsley (1940) cited a specimen from Gibraltar but we know of no other records and have seen no material. This taxon, as *O. maritima*, was included in the Red Data Book (Perring & Farrell, 1983) but only over-collection can affect it and it is somewhat protected from this by the inaccessibility of its habitat.

11. **O. hederae** Duby, *Bot. Gall.* **1**: 350 (1828).
O. barbata Sm., *Engl. Bot.* **6**: t.2859 (1841), non Poir, in Lam., *Encyclop.* **4**: 621 (1797).

English name: Ivy Broomrape.

Illustrations: Figs 3F, 7C. Photographs in Lousley (1950: pl. 13), Bichard & McClintock (1975: pl. 49), Phillips (1977: 92, as *O. minor*); drawings in Martin (1965: pl. 66), Ross-Craig (1966, **23**: pl. 29), Garrard & Streeter (1983: 149).

Flowering stems simple, 10–60(–105) cm, strongly suffused purple, very rarely yellow, glandular-pubescent usually strongly swollen at the base. Spike dense to lax, flowers frequently from ground level, shoot often with conspicuous terminal 'bud'. Bracts 12–22 mm ovate-lanceolate to lanceolate, acuminate. Calyx 10–15 mm, bifid or entire. Corolla (10–)12–20(–22) mm, dull cream tinged reddish-purple; sparsely glandular to sub-glabrous, erecto-patent to patent tube slightly inflated below usually constricted distally; upper lip entire to emarginate, the lobes forwardly directed or spreading; lower lip with middle lobe just the largest, all sub-acute, crisped and denticulate. Stamens inserted 3–4 mm above corolla base; filaments ± glabrous below, occasionally sparsely glandular above. Stigma lobes partially united, yellow rarely pink tinged. Flowering period June to October. 2n=38*. Native, introduced or self sown in artificial habitats east of its native range; parasitic on Araliaceae.

Usually easily distinguished from the similar *O. minor* Sm. by its characteristically distally pinched corollas, the flower extending over most of the stem and the large terminal 'bud' of unopened flowers which give the spike a pointed top. In wild populations it is only parasitic on the Araliaceae but caution should be exercised as *O. minor* can also parasitize members of this family.

First discovered in the British Isles on Guernsey in 1726 and subsequently found along the south-western coast of England, Wales and in the Killarney area of Ireland (Fig. 18). This species was confused with *O. minor* and was included in it by Bentham & Hooker (1930) who considered the stigma colour and "other trifling characters" were not constant. Some populations of *O. hederae*

examined by us have pinkish stigmas but otherwise are typical. They may be distinguished from *O. minor* by the morphological features listed above.

O. hederae has been recorded as parasitizing *Hedera*, *Fatsia*, × *Fatshedera* and *Kaplopanax*. Plants on the latter at Royal Botanic Gardens, Kew were exceptionally robust, some over a metre tall! Jones (1987) succeeded in raising plants on *Trifolium pratense*. Records of hosts from other families have all proved to be based on misidentification of the parasite involved. The predominantly Atlantic coastal distribution of *O. hederae* suggests that it is primarily a parasite of *Hedera hibernica*. Inland stations may have arisen from wind borne seed but in most cases deliberate introduction is likely as many sites are in or near botanic gardens.

This species has a longer flowering period than any other British broomrape. Late-flowering plants will almost invariably be found in most populations when most spikes are dead. Populations of most *Orobanche* species flower simultaneously, the asynchronous appearance of *O. hederae* and its lengthy flowering period are presumably due to the evergreen nature of its host.

O. hederae is one of the commonest British broomrapes and certainly the most abundant in Ireland. It is not threatened and may be increasing slowly as it exploits cultivated *Hedera* outside its natural range.

12. **O. crenata** Forskål, *Fl. Aegypt. Arab.* 113 (1775).
O. speciosa DC., *Fl. Fr.* **6**: 393 (1815).
O. pruinosa Lapeyr., *Hist. Abr. Pl. Pyr. Suppl.* 87 (1818).

English names: Carnation-scented Broomrape.

Illustrations: Figs 2E, 6B. Photographs in Huxley & Taylor (1977: pl. 272), Polunin (1969: pl. 131), Polunin & Huxley (1965: pl. 181).

Flowering stem simple, 15–80(–120) cm, densely glandular-pubescent, somewhat bulbous at base. Inflorescence usually rather lax, with numerous flowers. Bracts 15–25 mm, ± villous, ovate-lanceolate to linear-lanceolate, acuminate. Calyx 10–20 mm, unequally bifid. Corolla (12–)20–30 mm, creamy white with purplish veination especially on the lips, yellow at the base, somewhat campanulate, erecto-patent to horizontal; lips divergent, upper strongly bi-lobed forming an ± erect standard, lower with large sub-orbicular lobes. Stamens inserted 2–4 mm above corolla base, filaments hairy at least below. Stigma lobes white, yellow or pink, rarely darker. With a powerful, pleasant carnation scent. Flowering period May to August. n=19. Introduced, rarely persistent. Usually parasitic on herbaceous legumes or Pelargoniums in this country but it has an extensive host range of similar magnitude to that of the other main agricultural weed in the genus, *O. ramosa*.

British material of this species is often smaller and less floriferous than Continental plants, such depauperate plants may be confused with *O. loricata* Reichenb., *O. minor* Sm. or perhaps *O. reticulata* Wallr. It has also been confused with *O. caryophyllacea* Sm. probably because of its large, somewhat campanulate flowers, and strong scent. Its pale stigma, divergent corolla lips and villous stems and bracts combined with the strong scent are characteristic.

This attractive pernicious Mediterranean weed has been reported as a casual only very rarely in Britain (Fig. 19). It was first discovered in a bean field near Charlton, Glos. in 1845 and then on peas near Stroud in 1863. Both were originally recorded as *O. caryophyllacea* Sm. (Riddlesdel *et al.* 1948). It had also been found amongst peas in a Bridgewater, Somerset garden in 1860 where it was reputedly 115 cm tall. *O. crenata* was next discovered at St Philips Marsh, Bristol in 1905; this area was rich in Mediterranean weeds at this time, *O. ramosa* being recorded twice. Bowen (1968) reports this species as occurring on a *Pelargonium* in a garden in Cholsey, Berks.

The majority of recent British records are from the Upminster/Cranham area of S. Essex. It was first found here in 1950 in a garden flowerbed at 13 New Place Gardens where it reappeared with greater vigour in 1951. It was next found in a garden in Peterborough Avenue, Upminster in August 1975. The following year Dr K. J. Adams was visiting a proposed nature reserve site at Cranham marsh when he detected a strong carnation scent. He tracked this down to a small but thriving population of *O. crenata* in the marshy corner of a partially ploughed field. This was less than 1 km

from the previous garden finds. *O. crenata* continued to increase in this site and when visited in 1982 the population was of about 200 plants parasitizing *Vicia hirsuta* and *V. tetrasperma*. Regrettably, the field was ploughed up in 1983 and fewer than ten plants were reported on a visit by the Thurrock Natural History Society (C. J. Studholme, pers. comm.). Since then the plant has not been refound and the original site looks unsuitable. It was thus feared that *O. crenata* was extinct in this area (Rumsey 1986). However, in 1986 three plants were found in a field of peas c. 1 km N.N.E. of the previous colony (Mrs. M. Smith, pers. comm.).

Adams (1984) speculated as to the status of the species in this area and considered it may be native. This is unlikely given the extra-British distribution of *O. crenata*. Although broomrapes often exhibit pronounced fluctuations in population size, the steady increase would also suggest it was not native. It is not certain whether the 1950/1 plants gave rise to the main colony or vice versa, whatever the sequence of events the original mode of introduction remains unclear.

Several other casual occurrences have been reported or are evidenced by herbarium specimens: a depauperate plant was collected on a potted *Daucus* at the Cambridge Botanic Garden, although initially misidentified as *O. picridis* var. *carotae* (*Graham*, **CGE**). Similarly, a record of *O. rapum-genistae* from Clehonger, Hereford in 1968 was probably *O. crenata*, as the plant was parasitic on *Vicia faba*. This is the preferred host for *O. crenata* in the Mediterranean region, whereas *O. rapum-genistae* exclusively parasitizes shrubby legumes, especially *Cytisus*, *Ulex* and *Genista*. A single plant parasitizing *Vicia bithynica* in the natural order beds at Kew may have been intentionally introduced. The only other record known to us is of a potful of parasites and *Pelargonium* brought to the 1984 B.S.B.I. Exhibition Meeting. Unlike most broomrape species, *O. crenata* is dependent on insect visitation for seed set. Damper, cooler climates result in later flowering and perhaps fewer pollinator visits. This may in turn result in inadequate seed bank establishment and effectively thus governs the northern limit of distribution. The copious seed production potential and efficient seed dispersal of just one plant combined with the lengthy period of sustainable seed dormancy (probably greater than ten years) could account for its prolonged survival in a marginally suitable habitat as in Essex. It is to be hoped that it will re-establish itself in the E.N.T. Nature Reserve where it can be more effectively conserved.

The climatic changes experienced recently, coupled with more frequent Faba bean crop cultivation, may result in the more frequent occurrence and establishment of this species in the British Isles. It could become a major and serious weed species in the 21st century.

13. **O. flava** C.F.P. Mart. ex F.W. Schultz, *Beitr. Kenntn. Deutsch. Orob.* 9 (1829).

English name: Butterbur Broomrape.

Illustrations: Fig. 2B.

Flowering stem simple, 20–65 cm, glandular-pubescent, scarcely swollen at base, yellowish. Inflorescence rather dense. Bracts 13–20 mm, oblong to lanceolate, acute to acuminate. Calyx 8–15 mm, unequally bidentate or entire. Corolla (12–)15–22 mm, yellow tinged with red, erecto-patent to patent, uniformly curved; upper lip ± bilobed, erect or recurved at maturity; lower lip minutely ciliate or glabrous, middle lobe the largest. Stamens inserted 4–6 mm above corolla base; filaments hairy. Stigma pale yellow, style becoming exserted and convolute. Flowering period June to August. 2n=38. Introduced, parasitic on Compositae.

Closely resembles *O. lucorum* A. Braun, with which it grows in the Oxford Botanic Garden, and could be confused with the native *O. elatior* from which it differs in the exserted style and the choice of host.

Known only as an introduction at the Oxford Botanic Garden where it parasitizes *Petasites*, *Adenostyles* and related genera in the natural order beds (*Bowen*, **RNG**). As suitable hosts are widespread in this country it may become established elsewhere.

14. **O. lucorum** A. Braun in Rohling, *Deutschl. Fl.*, 3rd ed., **4**: 456 (1833).

English name: Barberry Broomrape.

Illustration: Fig. 2C.

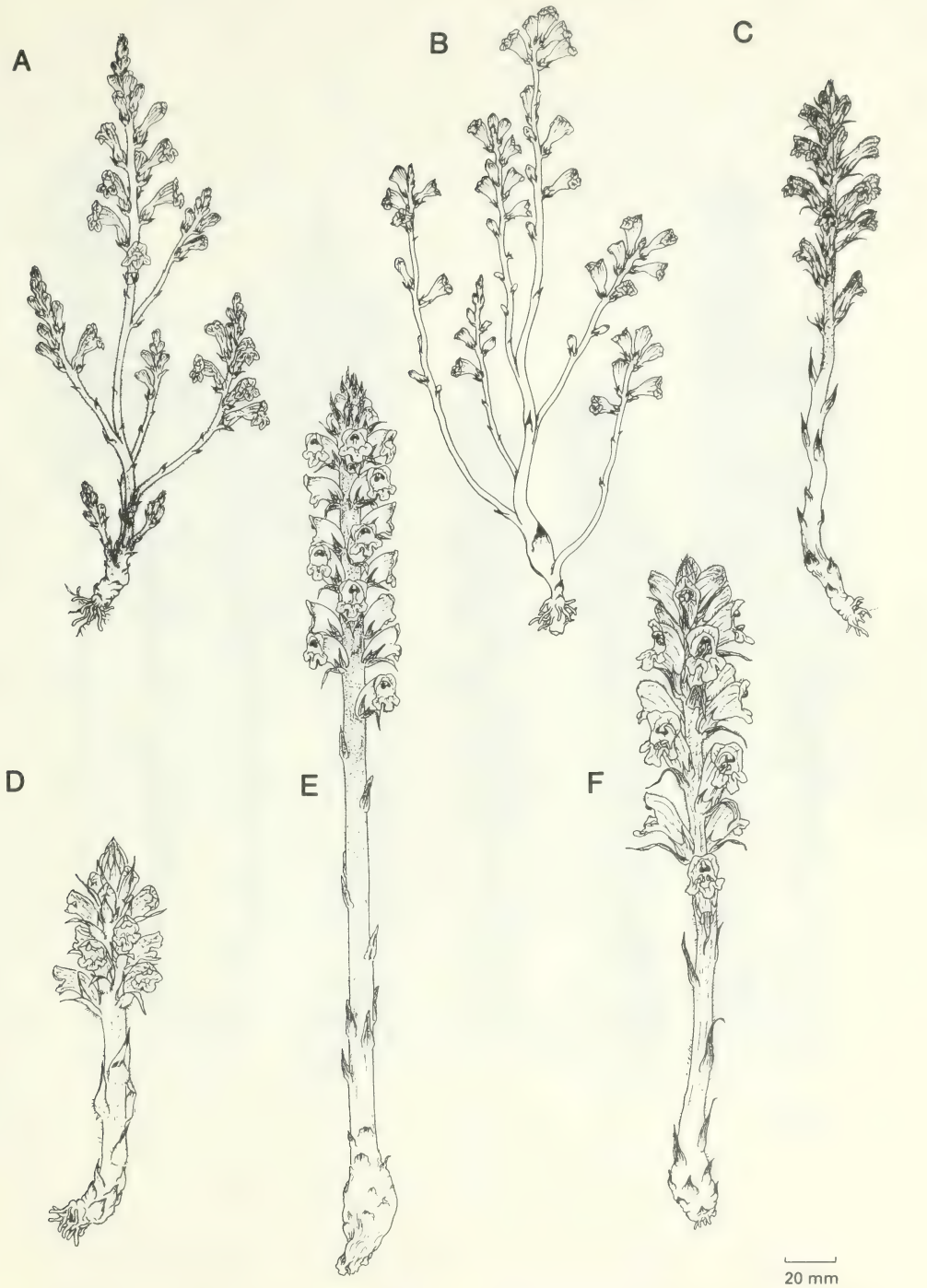

FIGURE 1. Morphology of British *Orobanche* species: A) *O. ramosa* L., B) *O. aegyptiaca* Pers., C) *O. purpurea* Jacq., D) *O. alba* Steph. ex Willd., E) *O. reticulata* Wallr., F) *O. caryophyllacea* Sm.

FIGURE 2. Morphology of British *Orobanche* species: A) *O. elatior* Sutton, B) *O. flava* C. F. P. Mart. ex F. W. Schultz, C) *O. lucorum* A. Braun, D) *O. rapum-genistae* Thuill., E) *O. crenata* Forskål

FIGURE 3. Morphology of British *Orobanche* species: A) *O. loricata* Reichenb., B) *O. minor* Sm. var. *minor*, C) *O. minor* Sm. var. *compositarum* Pugsley, D) *O. minor* Sm. var. *flava* E. Regel, E) *O. minor* Sm. var. *maritima* (Pugsley) Rumsey & Jury, F) *O. hederae* Duby

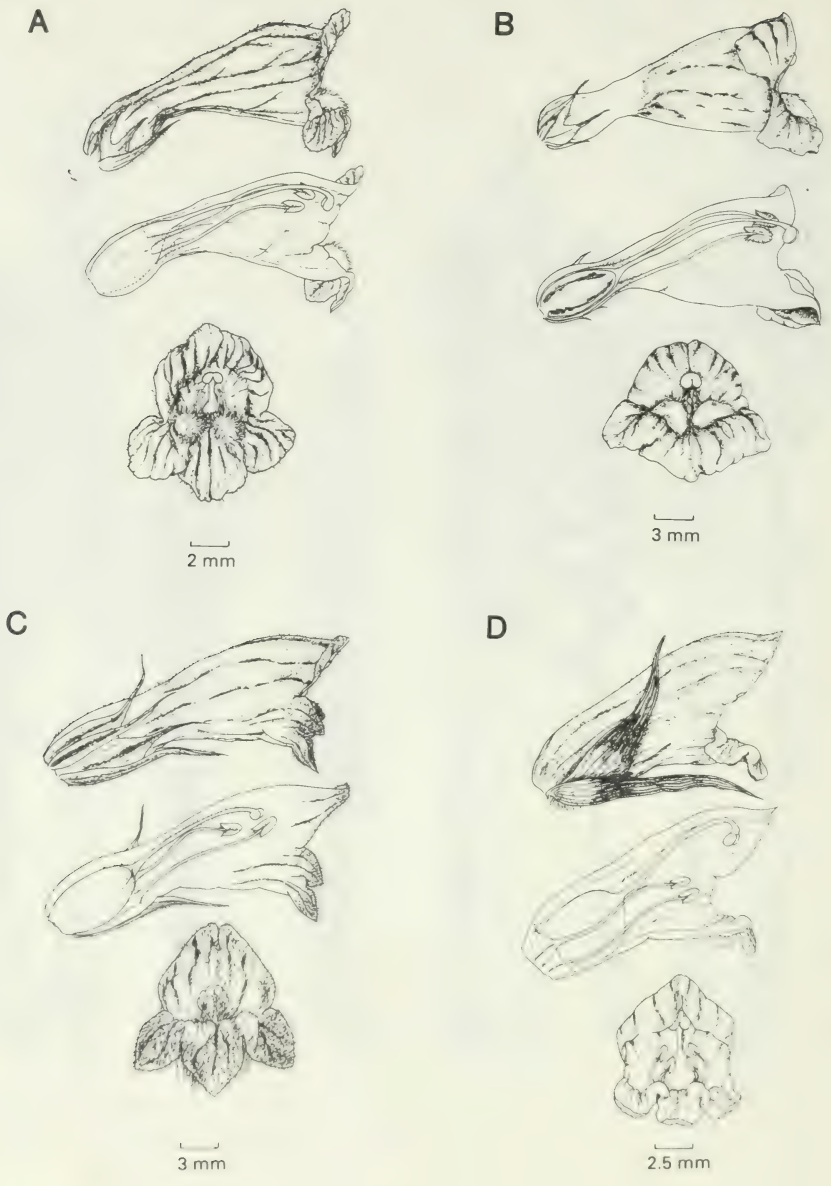

FIGURE 4. Corolla morphology of British *Orobanche* species: A) *O. ramosa* L., B) *O. aegyptiaca* Pers., C) *O. purpurea* Jacq., D) *O. alba* Steph. ex Willd.

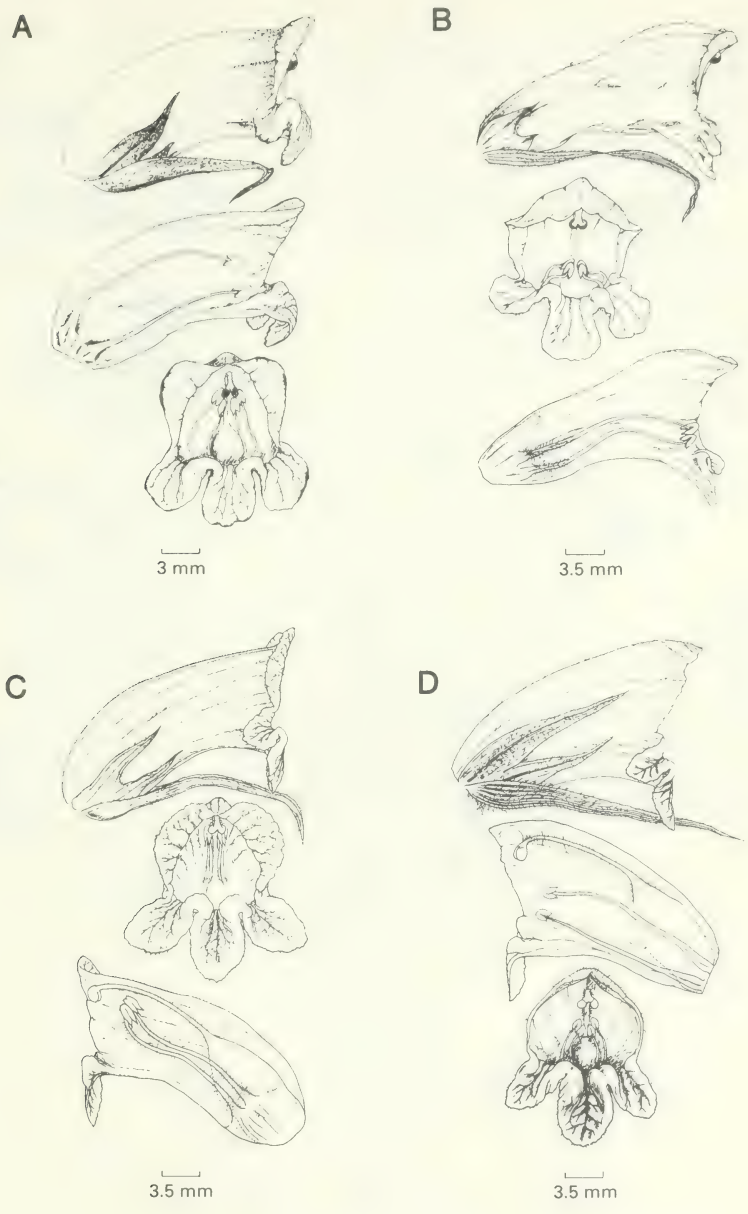

FIGURE 5. Corolla morphology of British *Orobanche* species: A) *O. reticulata* Wallr., B) *O. caryophyllacea* Sm., C) *O. elatior* Sutton, D) *O. rapum-genistae* Thuill.

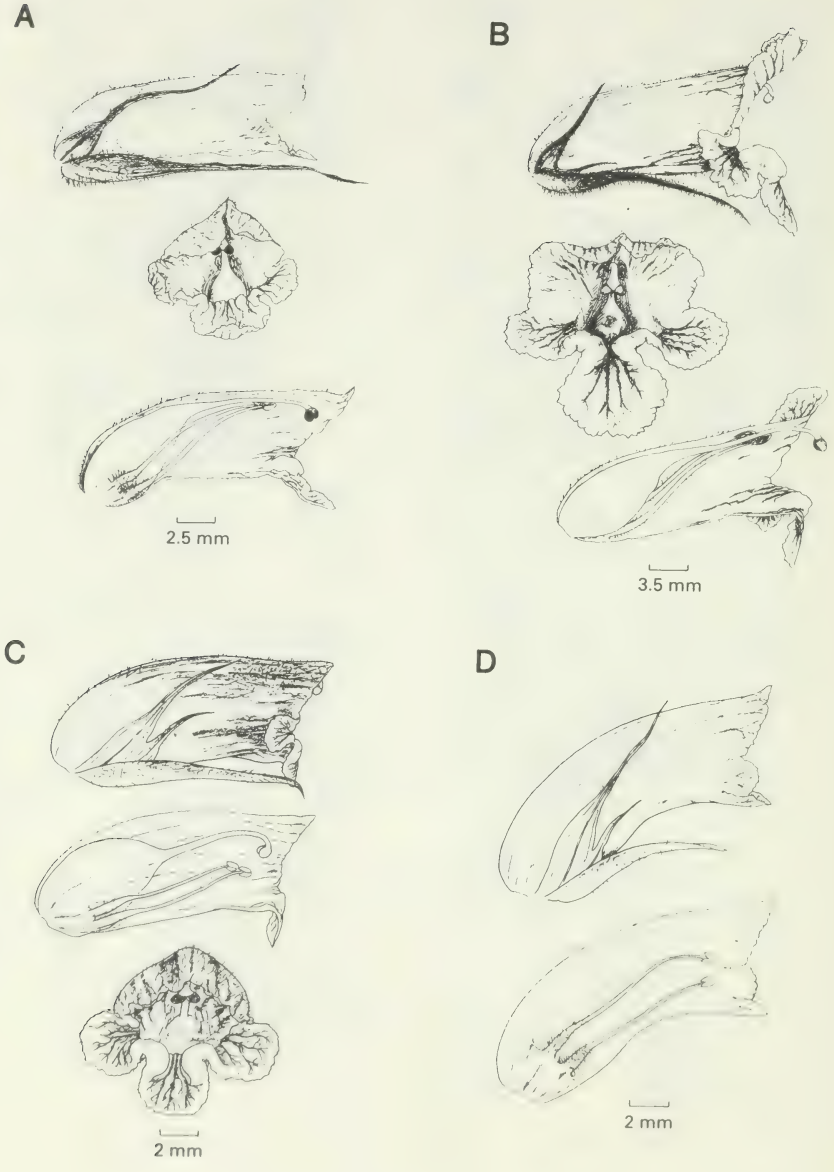

FIGURE 6. Corolla morphology of British *Orobanche* species: A) *O. loricata* Reichenb., B) *O. crenata* Forskål, C) *O. minor* Sm. var. *minor*, D) *O. minor* Sm. var. *compositarum* Pugsley

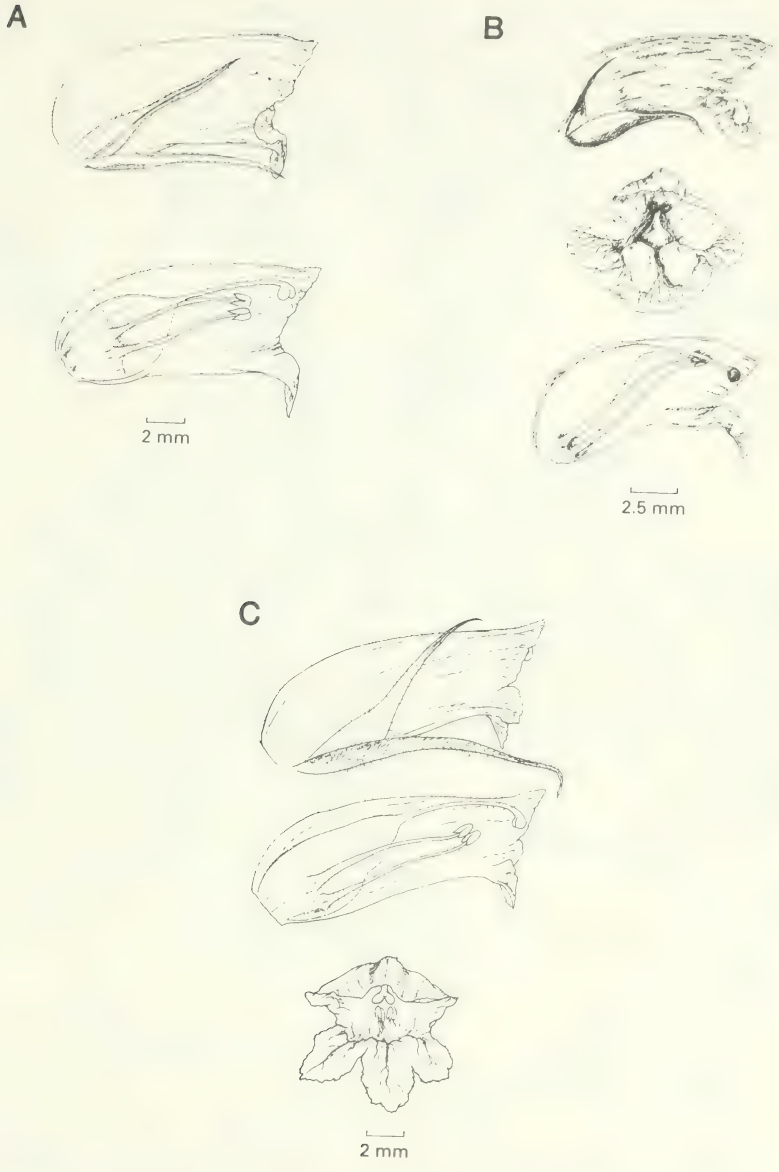

FIGURE 7. Corolla morphology of British *Orobanche* species: A) *O. minor* Sm. var. *flava* E. Regel, B) *O. minor* Sm. var. *maritima* (Pugsley) Rumsey & Jury, C) *O. hederae* Duby

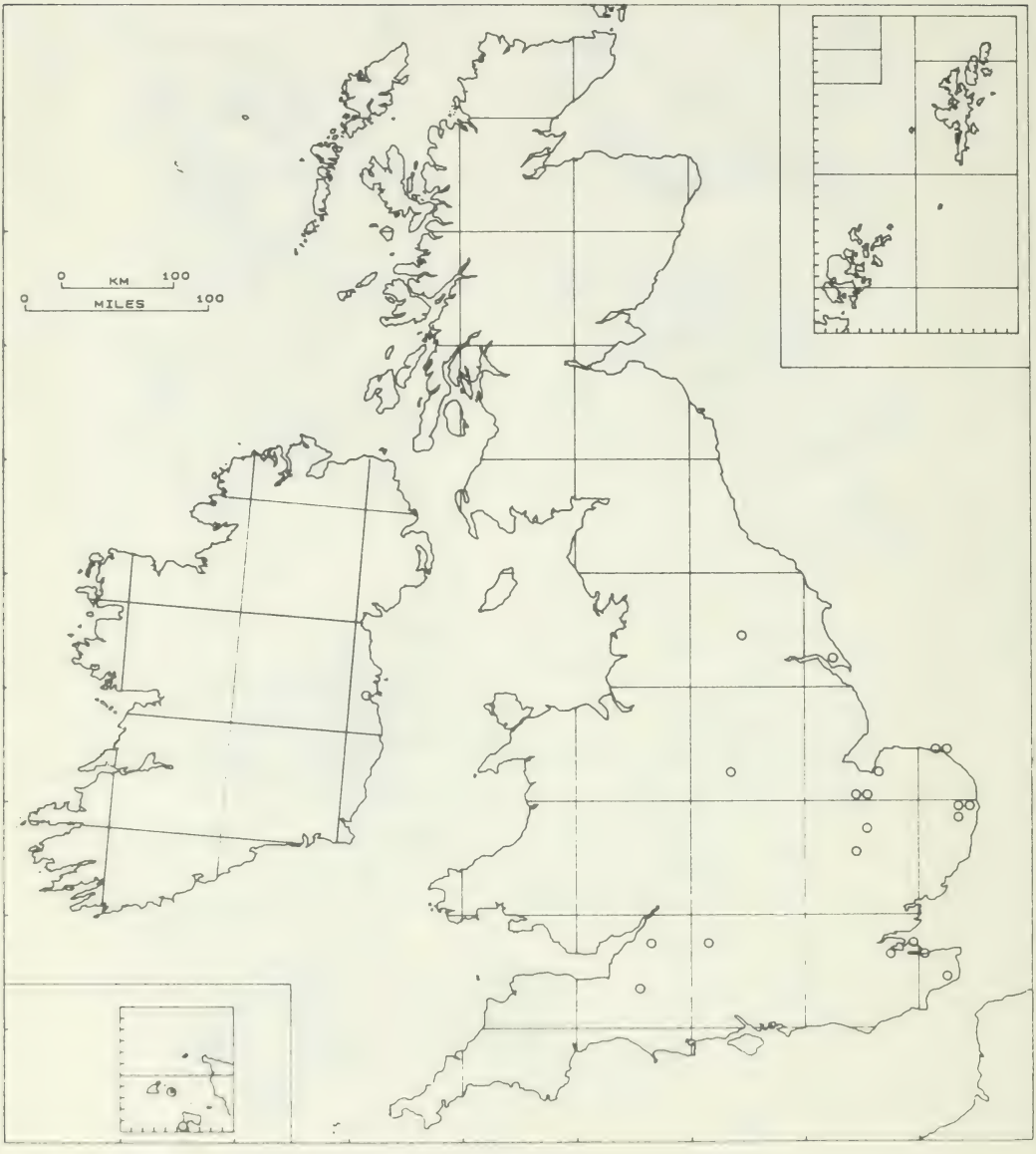

FIGURE 8. Distribution of *O. ramosa* L.; ● = post-1950 record, ○ = pre-1950 record.

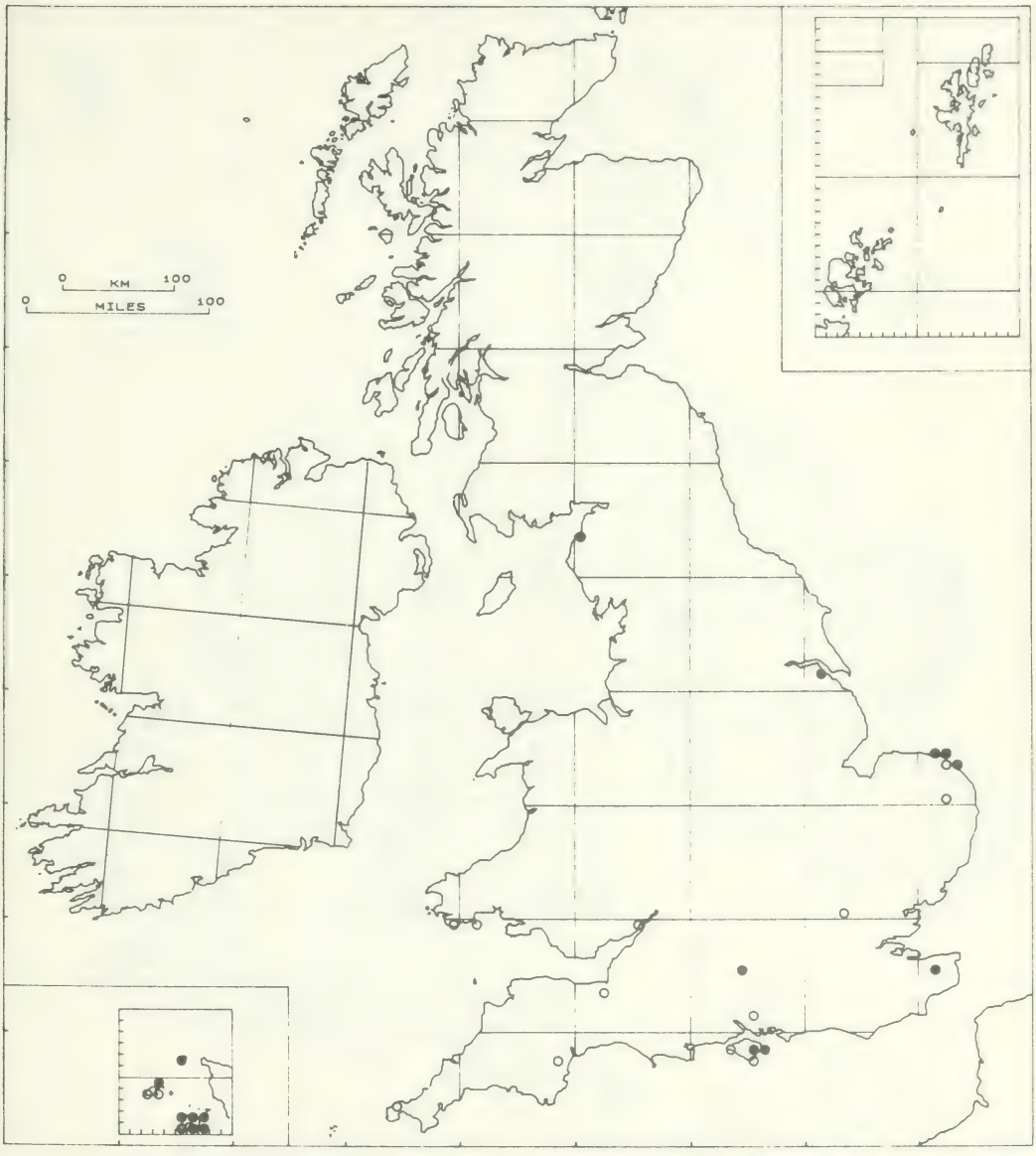

FIGURE 9. Distribution of *O. purpurea* Jacq.; ● = post-1950 record, ○ = pre-1950 record.

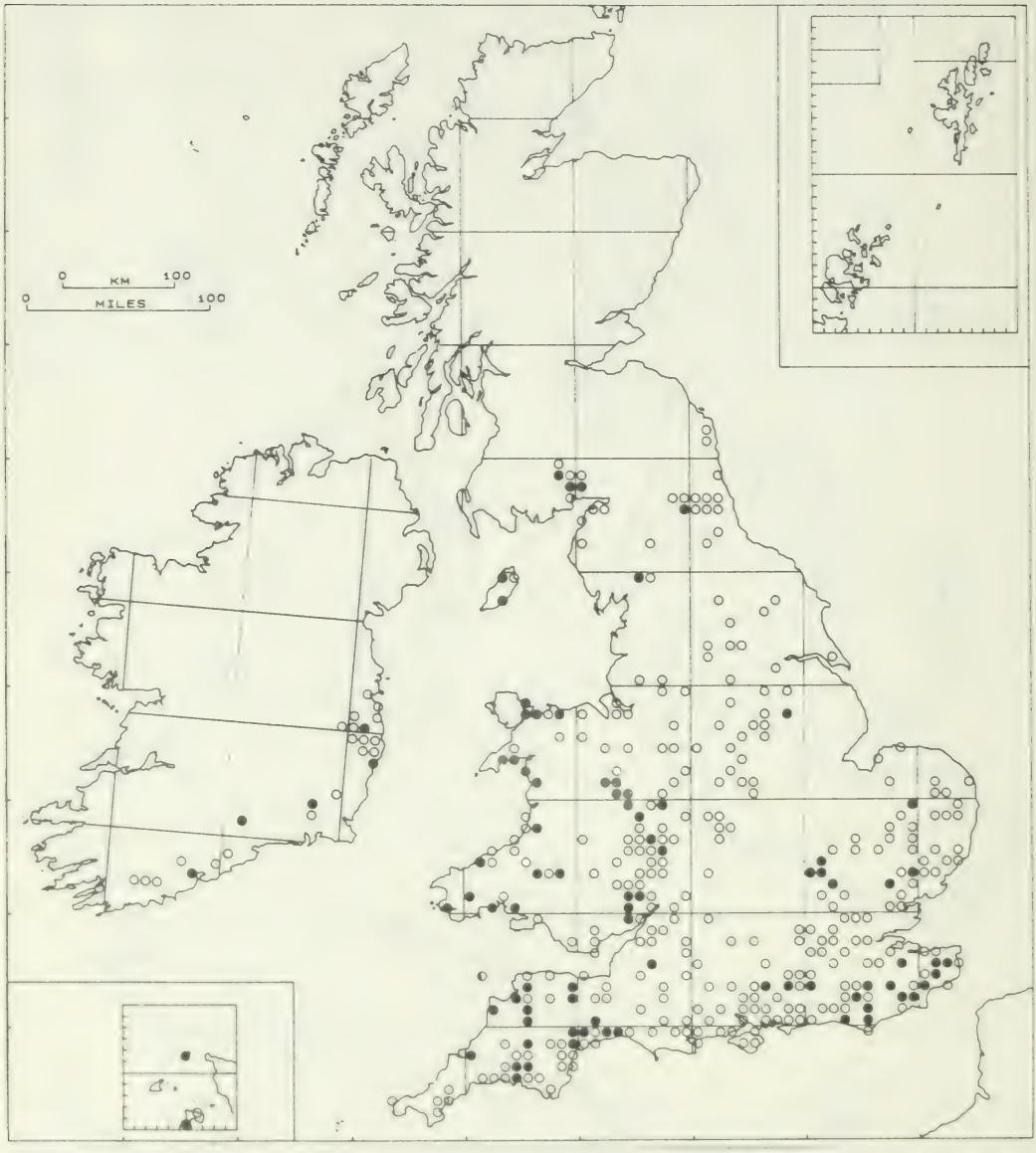

FIGURE 10. Distribution of *O. rapum-genistae* Thuill.; ● = post-1950 record, ○ = pre-1950 record.

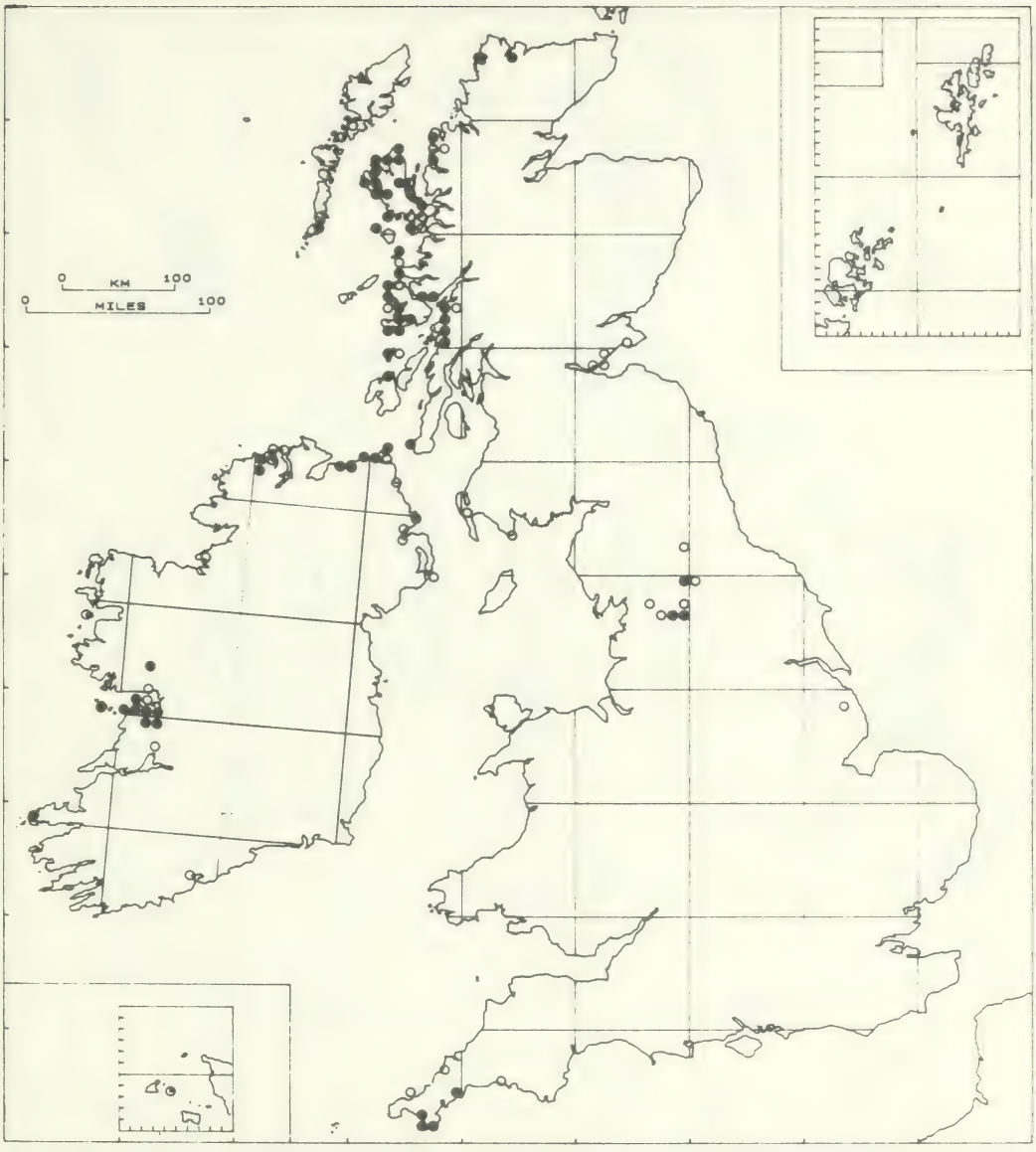

FIGURE 11. Distribution of *O. alba* Steph. ex Willd.; ● = post-1950 record, ○ = pre-1950 record.

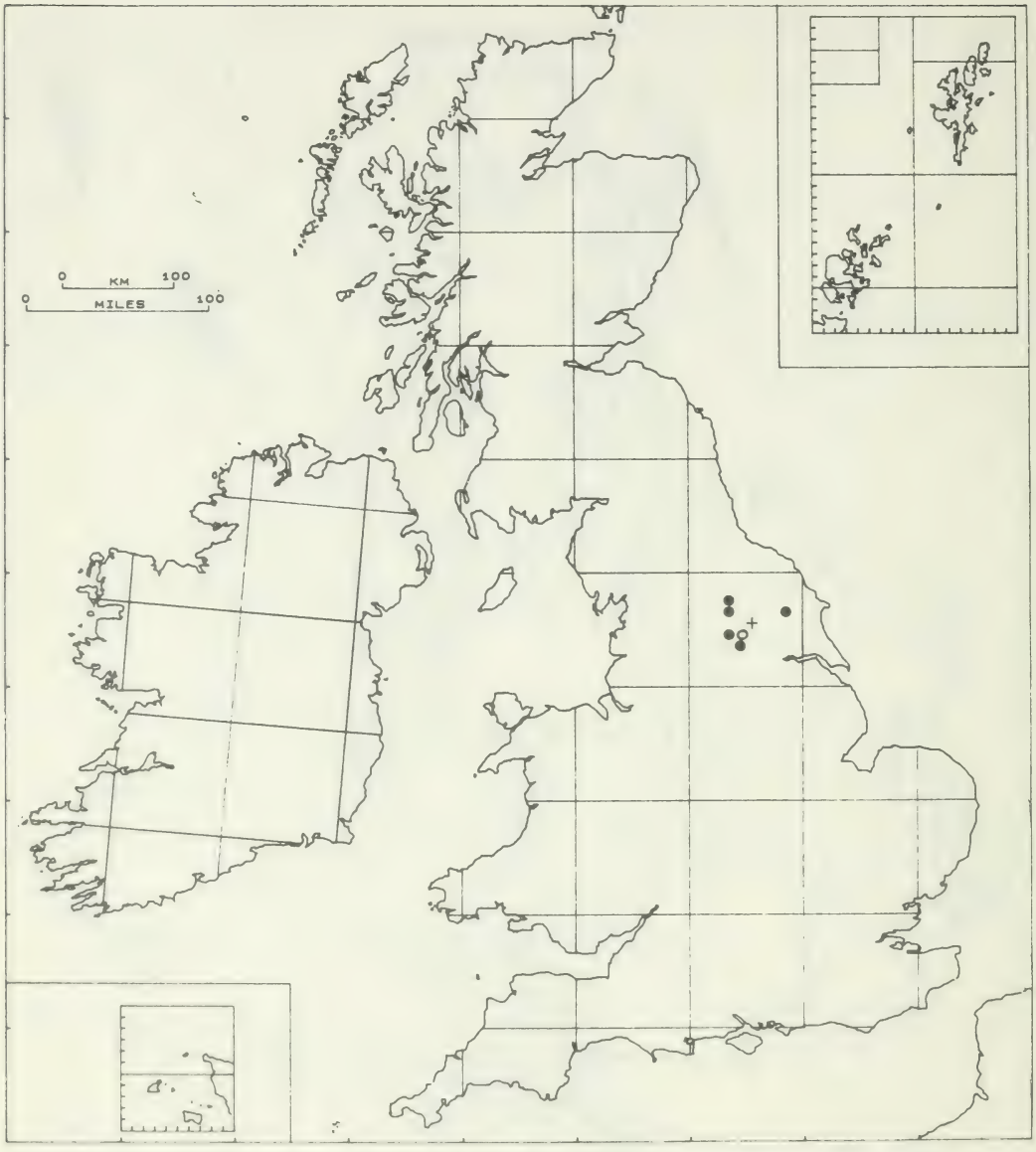

FIGURE 12. Distribution of *O. reticulata* Wallr.; ● = post-1950 record, ○ = pre-1950 record, + = introduction or casual.

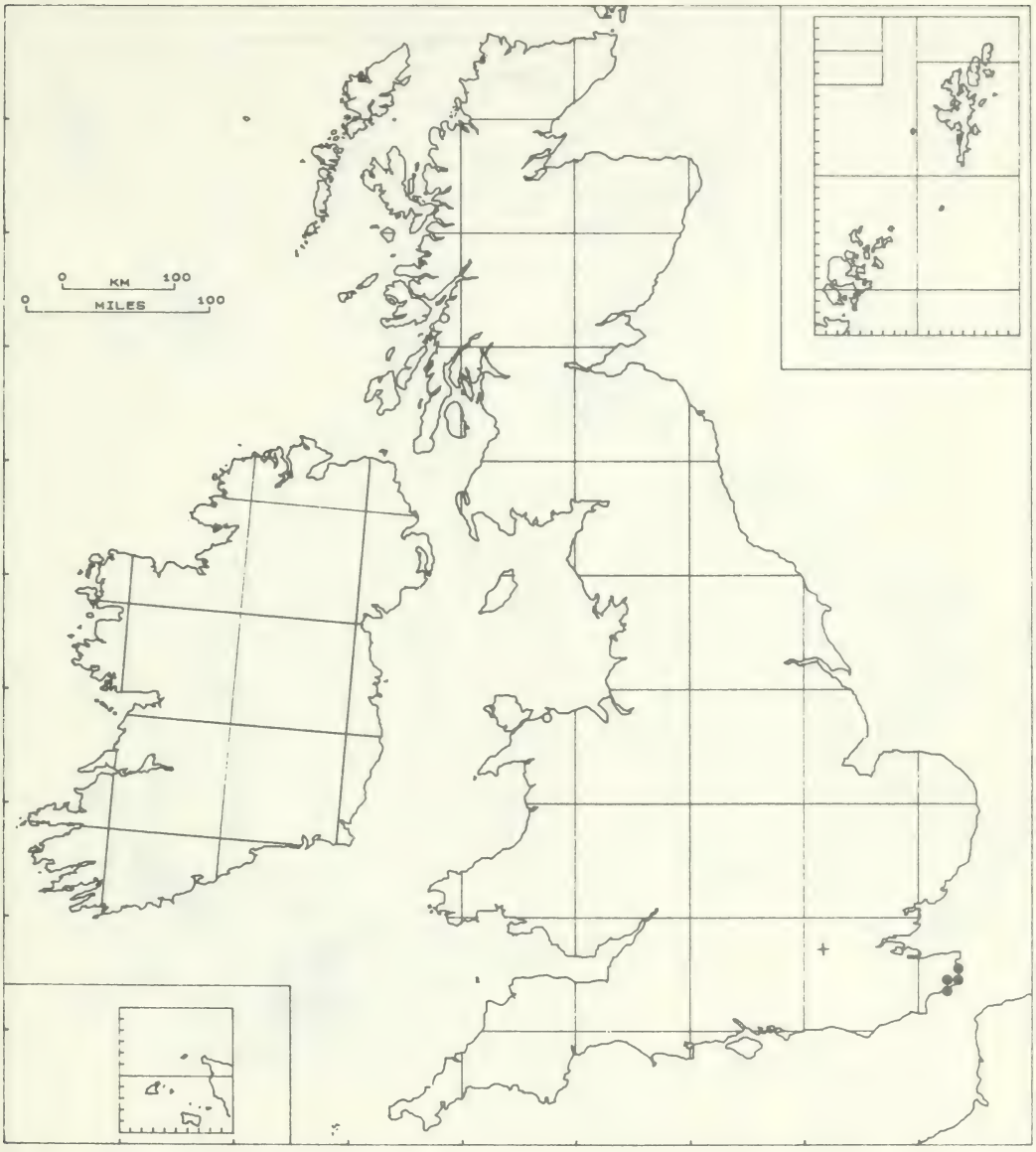

FIGURE 13. Distribution of *O. caryophyllacea* Sm.; ● = post-1950 record, ○ = pre-1950 record, + = introduction or casual.

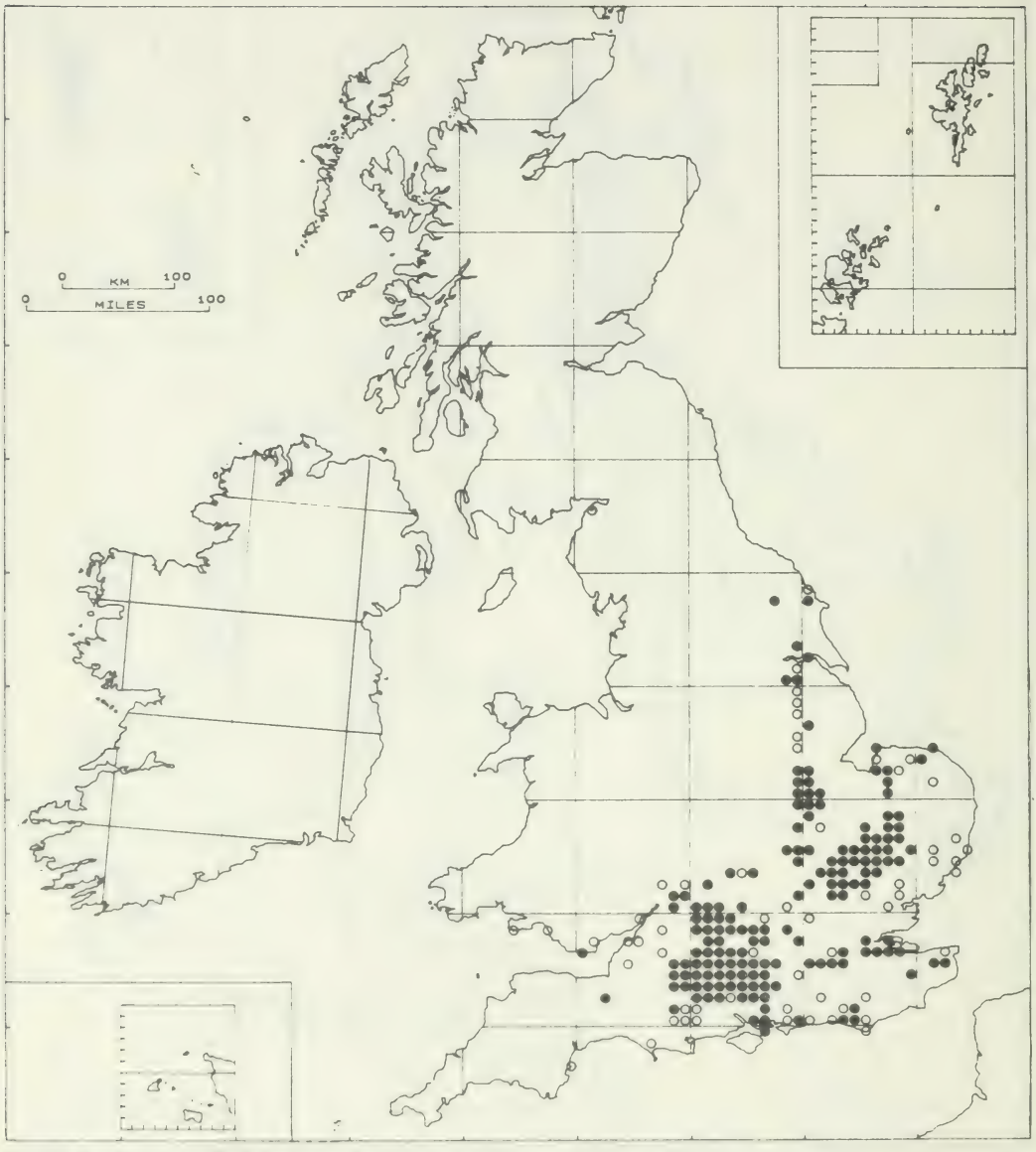

FIGURE 14. Distribution of *O. elatior* Sutton; ● = post-1950 record, ○ = pre-1950 record.

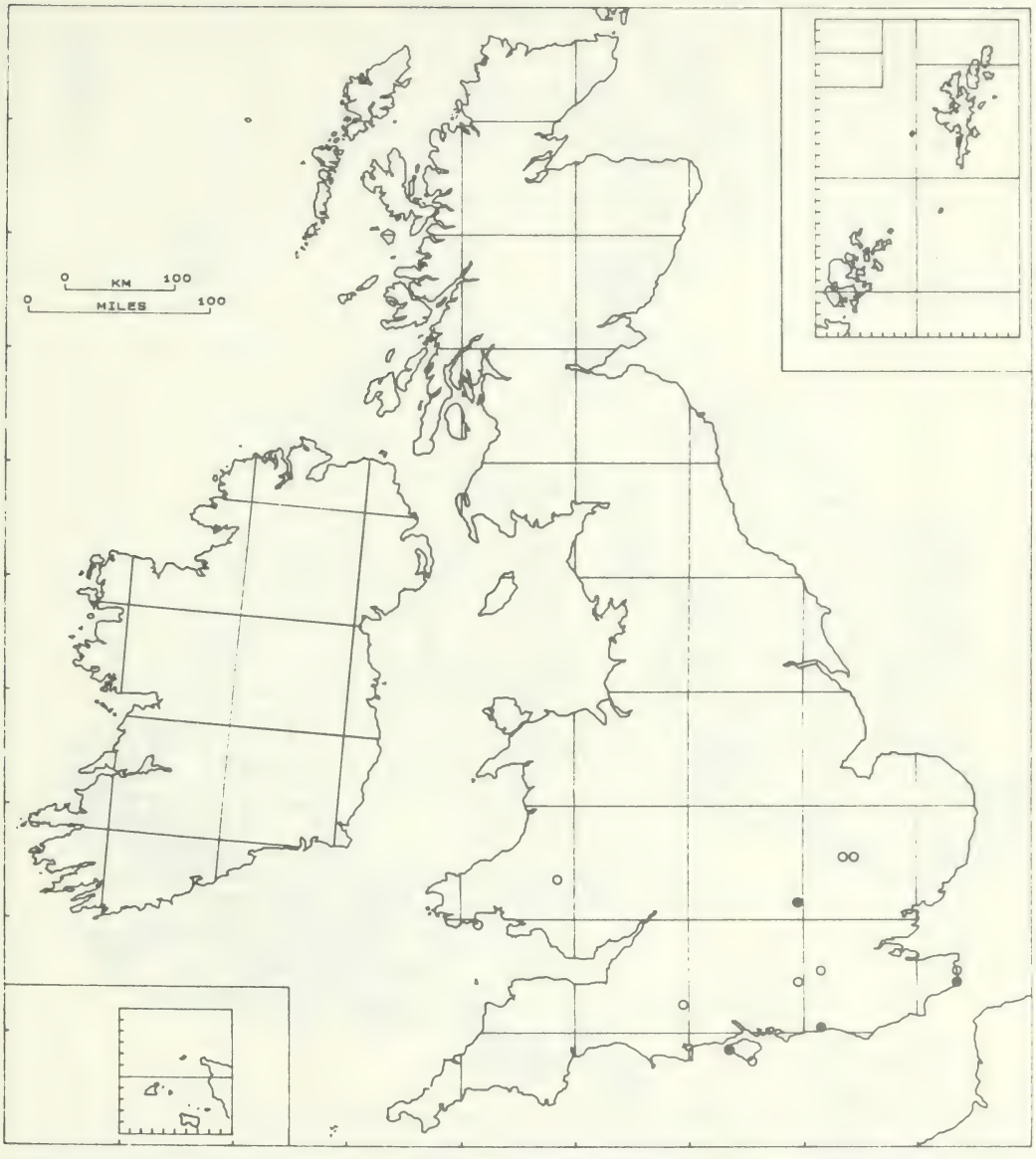

FIGURE 15. Distribution of *O. loricata* Reichenb.; ● = post-1950 record, ○ = pre-1950 record.

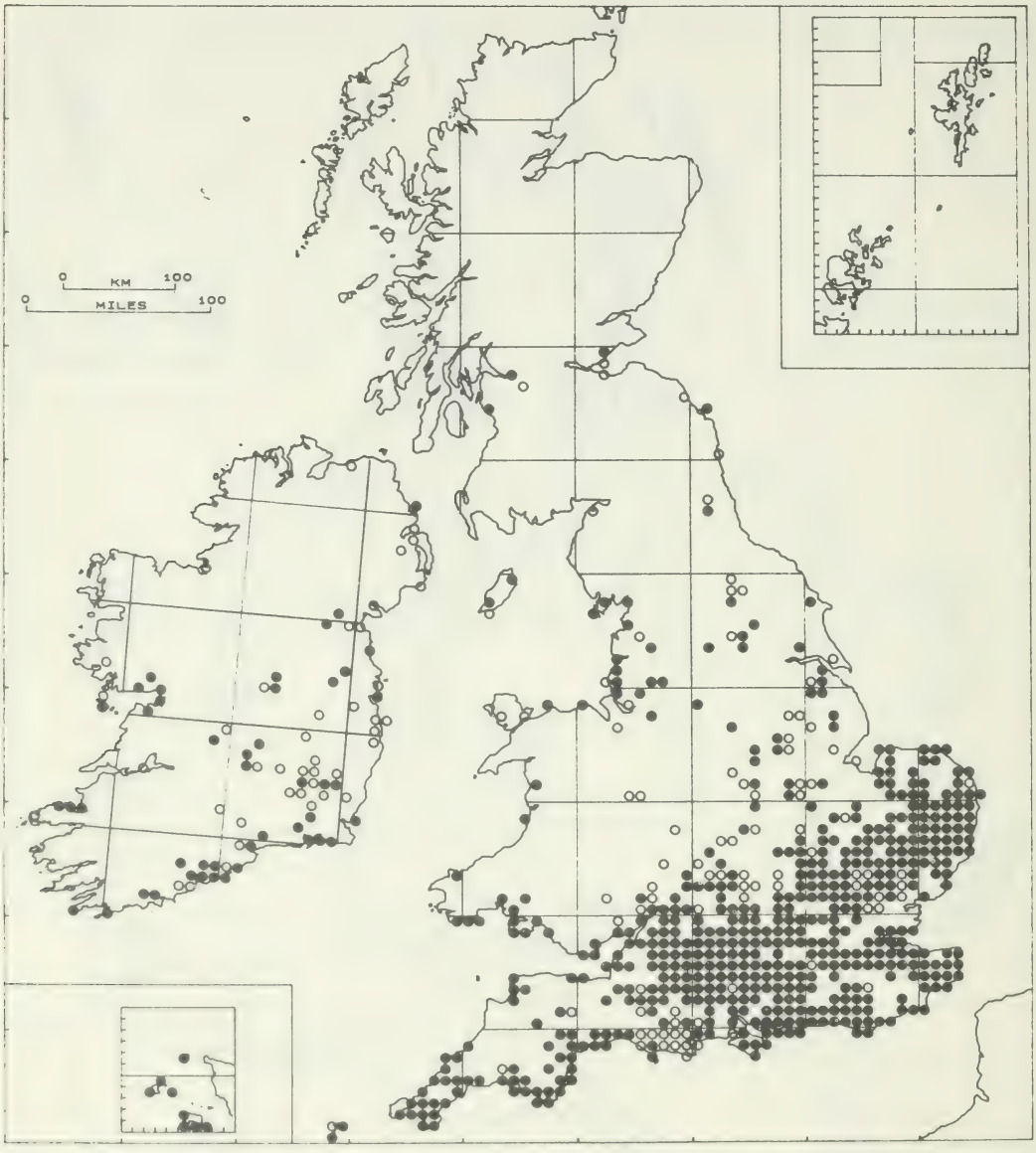

FIGURE 16. Distribution of *O. minor* var. *minor*; ● = post-1950 record, ○ = pre-1950 record. The map includes all records of the species other than those attributed to the rarer varieties.

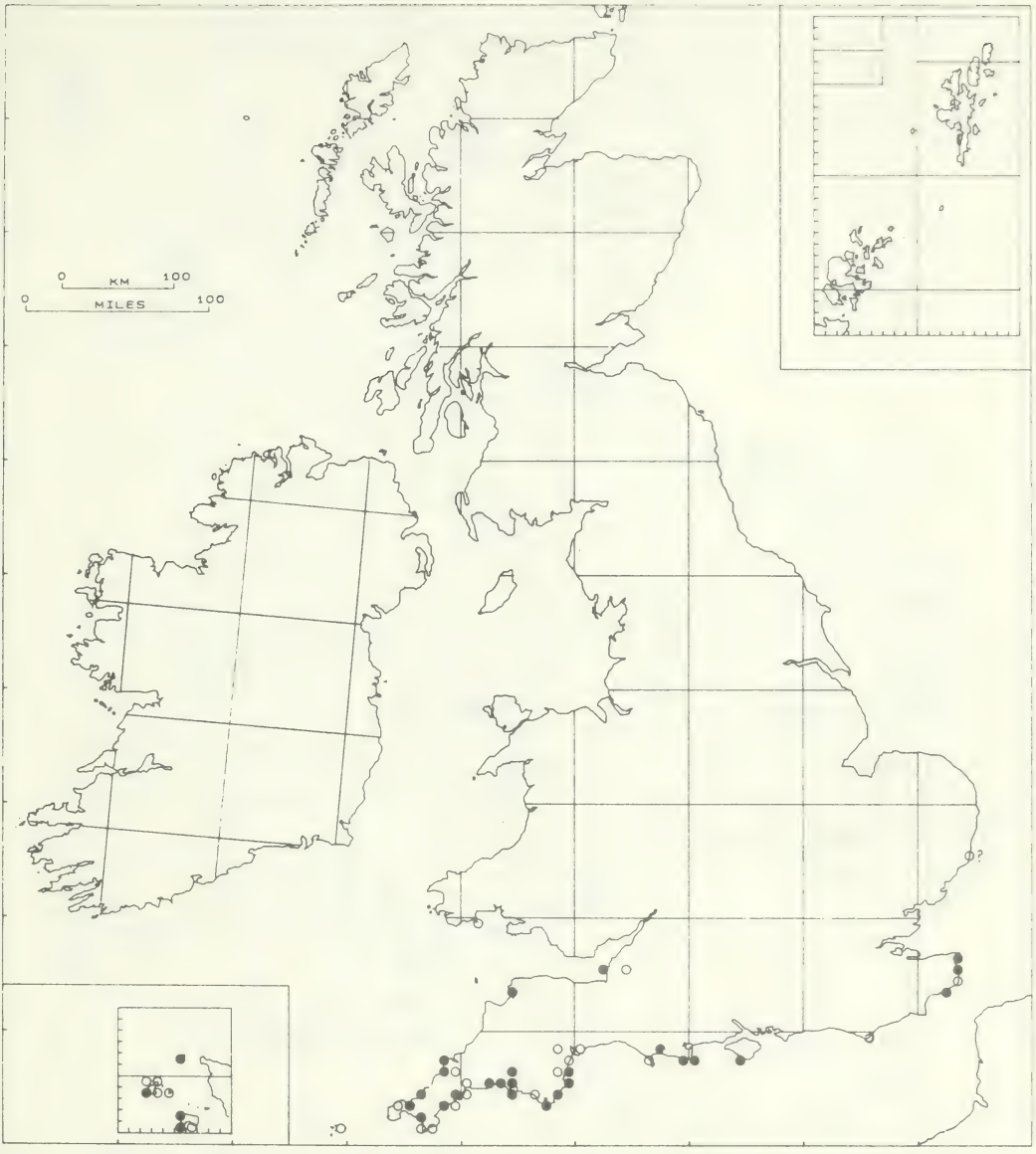

FIGURE 17. Distribution of *O. minor* var. *maritima* (Pugsley) Rumsey & Jury; ● = post-1950 record, ○ = pre-1950 record.

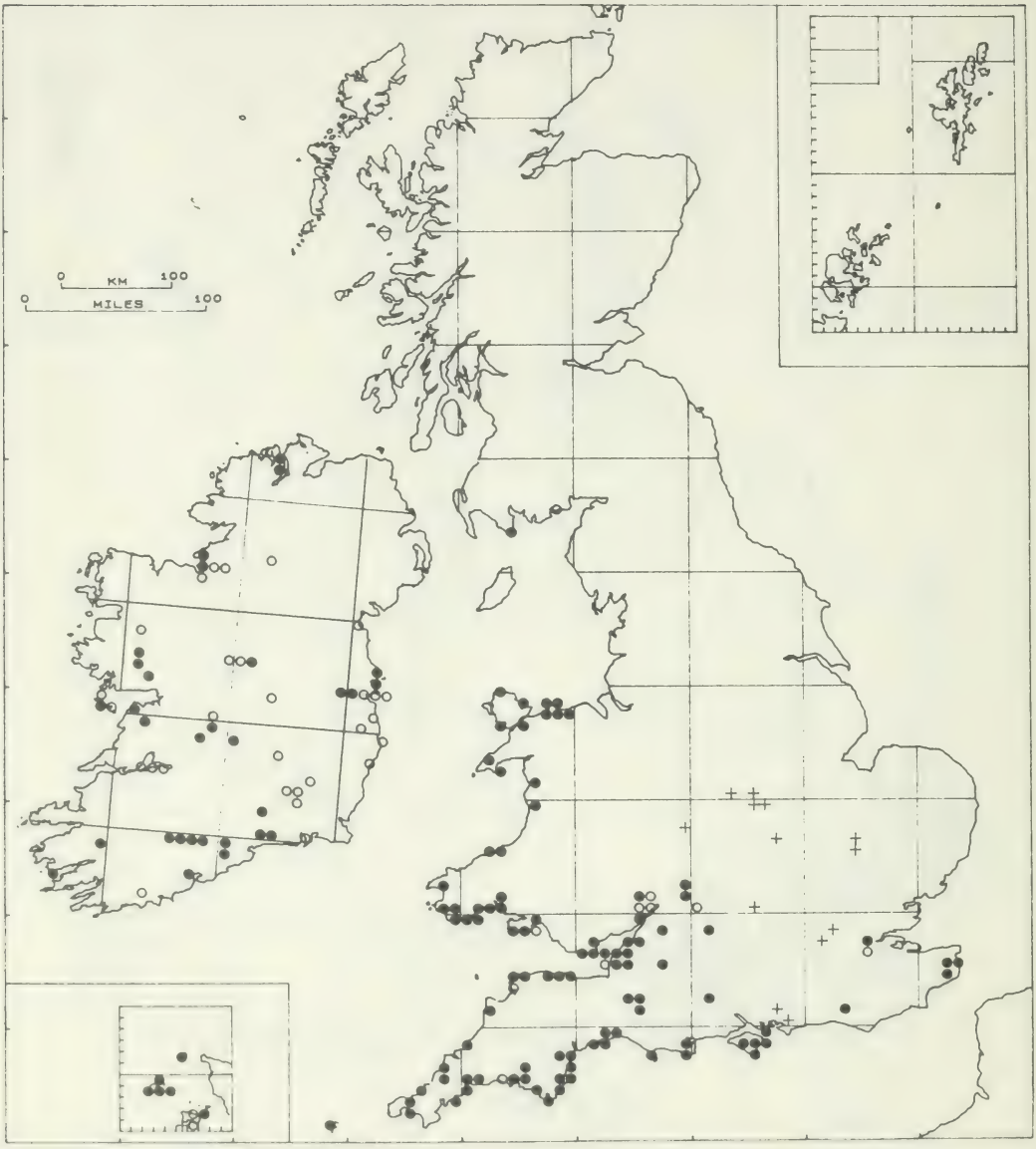

FIGURE 18. Distribution of *O. hederae* Duby; • = post-1950 record, ○ = pre-1950 record, + = introduction or casual.

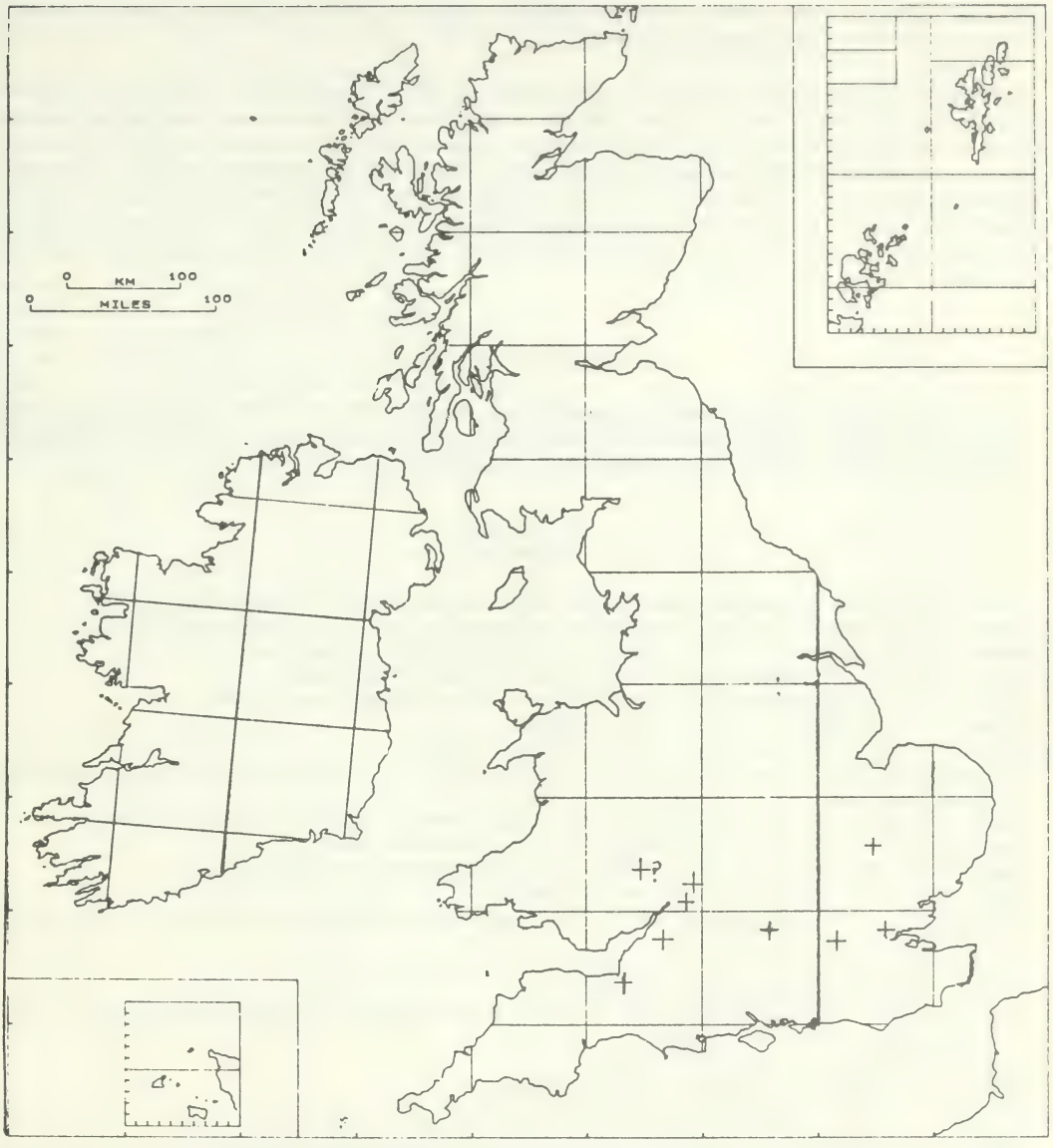

FIGURE 19. Distribution of *O. crenata* Forskål; + = introduction or casual.

Flowering stem simple, 15–50 cm, glandular-pubescent, scarcely swollen at the base, yellowish. Inflorescence rather dense. Bracts 13–25 mm, oblong to lanceolate, acute to acuminate. Calyx 8–15 mm, unequally bidentate or entire. Corolla 15–22 mm, yellow tinged with red, erecto-patent to patent; upper lip ± emarginate, porrect; lower lip with conspicuously ciliate sub equal lobes. Stamens inserted 2–3 mm above the corolla base; filaments hairy. Stigma lobes yellow becoming reddish with age. Style scarcely exserted, slightly convolute. Flowering period June to August. Introduced deliberately, parasitic on *Berberis*.

Sometimes difficult to distinguish from the closely related *O. flava* Mart. Material from Oxford could also be confused with *O. rapum-genistae* from which it differs in its hairy filaments and its flowers not dark red inside. Erroneously reported from Surrey, one specimen is of somewhat atypical *O. elatior* (**CGE**), another is surprisingly *O. caryophyilacea* (herb. H. C. Watson, **K**). *O. lucorum* is currently known only from the Botanic gardens at Oxford (*Bowen*, **RNG**) and St Andrews (*Ratter*, **E**). At Oxford it parasitizes a range of *Berberis* cultivars. Given the scarcity of *Berberis* in native stations, if it is to become established in this country it will be found in parks and gardens.

ACKNOWLEDGMENTS

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REFERENCES

Adams, K. J. (1984). *Orobanche crenata* Forskål – native in the British Isles? *Watsonia* **15**: 161–162.
Beck von Mannagetta, G. (1930). *Orobanche* in A. Engler, ed. *Das Pflanzenreich* **4** (261): 1–348.
Bentham, G. & Hooker, J. D. (1930). *Handbook of the British flora*, 7th ed. Ashford.
Bevis, J., Kettell, R. & Shepard, B. (1978). *Flora of the Isle of Wight*. London.
Bichard, J. D. & McClintock, D. (1975). *Wild flowers of the Channel Islands*. London.
Bowen, H. J. M. (1968). *Flora of Berkshire*. Oxford.
Butcher, R. W. (1961). *A new illustrated British Flora*, **2**. London.
Clapham, A. R. (1952). *Orobanche* L., in Clapham, A. R., Tutin, T. G. & Warburg, E. F. *Flora of the British Isles*. Cambridge.
Dony, J. G., Jury, S. L. & Perring, F. H. (1986). *English names of wild flowers*, 2nd ed. Reading.
Garrard, I. & Streeter, D. (1983). *Wild flowers of the British Isles*. London.
Gilmour, J. & Walters, S. M. (1954). *Wild flowers – botanizing in Britain*. London.
Good, R. (1984). *A concise Flora of Dorset*. Dorchester.
Hambler, D. J. (1958). Chromosome numbers in some members of the family Orobanchaceae. *Bot. J. Linn. Soc.* **55**: 772–777.
Huxley, A. & Taylor, W. (1977). *Flowers of Greece and the Aegean*. London.
Jermyn, S. T. (1974). *Flora of Essex*. Fingringhoe.
Jones, M. (1987). *Orobanche hederae* Duby in the British Isles, in Weber, H. Chr. & Fortstreuter, W., eds. *Parasitic flowering plants*. Marburg.
LeSueur, F. (1984). *Flora of Jersey*. St Helier.
Linnaeus, C. (1763). *Species plantarum*, 2nd ed. Stockholm.
Lousley, J. E. (1950). *Wild flowers of chalk and limestone*. London.
Margetts, L. J. & David, R. W. (1981). *A review of the Cornish flora 1980*. Redruth.
Marquand, E. D. (1901). *Flora of Guernsey and the Lesser Channel Islands*. London.
Martin, W. K. (1965). *The concise British flora in colour*. London.
Milne, M. (1986). Plant records. *Watsonia* **16**: 183–198.
Milne-Redhead, E. (1985). More hosts of *Orobanche*. *B.S.B.I. News* **41**: 29.
Moore, D. M. (1982). *Flora Europaea checklist and chromosome index*. Cambridge.
Musselmann, L. J. & Parker, C. (1982). Preliminary host ranges of some strains of economically important broomrapes (*Orobanche*). *Economic Botany* **36**: 270–273.
Perring, F. H. & Farrell, L. (1983). *British red data books: 1. Vascular plants*, 2nd ed. Lincoln.
Petch, C. P. & Swann, E. L. (1968). *Flora of Norfolk*. Norwich.

PHILLIPS, R. (1977). *Wild flowers of Britain*. London.
PHILP, E. G. (1982). *Atlas of the Kent flora*. Maidstone.
POLUNIN, O. (1969). *Flowers of Greece and the Balkans*. Oxford.
POLUNIN, O. & HUXLEY, A. (1965). *Flowers of the Mediterranean*. London.
PUGSLEY, H. W. (1940). Notes on *Orobanche* L. *J. Bot., Lond.* **78**: 105–116.
RAY, J. (1690). *Synopsis methodica stirpium Britannicarum*. London.
RAY, J. (1724). *Synopsis methodica stirpium Britannicarum*, 3rd ed. London.
RIDDELSDELL, H. J., HEDLEY, G. W. & PRICE, W. R. (1948). *Flora of Gloucestershire*. Bristol.
ROE, R. G. B. (1981). *Flora of Somerset*. Bridgewater.
ROSS-CRAIG, S. (1966). *Drawings of British plants*, **23**. London.
ROSVALL, A. (1979a). Snyltrotslaktet i Sverige. *Svensk Bot. Tidskr.* **73**: 27–37.
ROSVALL, A. (1979b). *Orobanche alba*, Timjansnyltrot pa Gotland. *Svensk Bot. Tidskr.* **73**: 1–6.
RUMSEY, F. J. (1985). *Orobanche caryophyllacea* Sm. in North Wales. *Watsonia* **15**: 277.
RUMSEY, F. J. (1986). *Orobanche crenata* Forskål. *B.S.B.I. News* **43**: 18–19.
SIMPSON, F. W. (1982). *Simpson's Flora of Suffolk*. Ipswich.
SITWELL, N. (1984). *Shell guides to Britain's threatened wildlife*. London.
SOWERBY, J. (1794). *English Botany*, **3**. London.
SOWERBY, J. (1797). *English Botany*, **6**. London.
SOWERBY, J. (1799). *English Botany*, **8**. London.
SOWERBY, J. (1807). *English Botany*, **25**. London.
SOWERBY, J. (1866). *English Botany*, 3rd ed. (Ed. J.T.B. Syme). London.
STRID, A. (1980). *Wild flowers of Mount Olympus*. Kifissia.
SUTTON, G. (1797). A description of five British species of *Orobanche*. *Trans. Linn. Soc. Lond.* **4**: 173–188.
WEBB, D. A. (1985). What are the criteria for presuming native status? *Watsonia* **15**: 231–236.
WEBB, D. A. & CHATER, A. O. (1972). *Orobanche* L., in TUTIN, T. G. *et al.*, eds. *Flora Europaea* **3**: 286–293. Cambridge.

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A re-assessment of *Pteridium aquilinum* (L.) Kuhn in Britain

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ABSTRACT

Starch gel electrophoresis has been used to assess the recent recognition of *Pteridium aquilinum* (L.) Kuhn subsp. *atlanticum* C. N. Page and subsp. *latiusculum* (Desv.) C. N. Page from Scotland. The former has been described as a new subspecies and the latter raises a variety to subspecific rank. Page's subsp. *atlanticum* is isozymically indistinguishable from typical subsp. *aquilinum*. Scottish material referred to subsp. *latiusculum*, on the other hand, is additive for isozymic markers characteristic of North American *latiusculum* and European *aquilinum* and may represent a hybrid between those taxa. Morphological intermediates between the hybrids and pure *aquilinum*, indicate that these plants may have crossed extensively with their neighbours. Preliminary isozymic studies of northern European plants which have been morphologically referred to North American *latiusculum* indicate that they may also be the product of past hybridisation. Our isozymic analyses and the DNA studies of others indicate that northern hemisphere *Pteridium* variants are closely related; the elevation of Tryon's var. *latiusculum* to subspecific rank therefore seems untenable.

INTRODUCTION

Tryon (1941) assigned all British bracken to a single variety, *Pteridium aquilinum* subsp. *aquilinum* var. *aquilinum*. Recent studies, however, have demonstrated considerable phenotypic plasticity (Page 1976, 1986) and genetic polymorphism (Wolf, Haufler & Sheffield 1987, 1988a,b; Sheffield, Wolf & Haufler 1989; Wolf, Sheffield & Haufler 1990). In 1989, Page used morphological features to diagnose two further subspecies of British bracken (subsp. *atlanticum* C. N. Page and subsp. *latiusculum* (Desv.) C. N. Page) and he hypothesised that hybridisation between these could have initiated the vigorous subsp. *aquilinum*. Given the sympatry of these three taxa, he suggested that introgression among them was commonplace, and was responsible for the spectrum of intergrading variability seen in British bracken today.

The presence of more than one bracken taxon in this country and the suggestion of active evolution within the species are of considerable importance to our understanding of this economically important weed and may have a profound influence on the formulation of control strategies. The aim of this study was therefore to elucidate the status and identity of these taxa using starch gel electrophoresis of their protein constituents (isozymes). This is a well established technique for the study of genetic variability (e.g. Gottlieb 1981) and systematic relationships (Crawford 1983, 1985). Work with pteridophyte species has shown that isozymes can be particularly useful in distinguishing cryptic species (Paris, Wagner & Wagner 1989) and in reconstructing episodes of hybridisation and allopolyploidy during reticulate evolution (Werth 1989). *Pteridium* isozymes have been the subject of intensive study both in Britain and the USA, and isozyme markers which reliably distinguish taxa recognised on morphological grounds have been found for all those investigated to date (Wolf 1986; Wolf, Haufler & Sheffield 1988a). Two taxa have been studied particularly closely; subsp. *aquilinum* sensu stricto and subsp. *latiusculum*. Both vary at

many of the 28 loci currently investigated, but two enzymes have alleles which are unique to one or the other variety: isocitrate dehydrogenase (IDH) and triosephosphate isomerase (TPI).

MATERIAL AND METHODS

Material was collected from the first recorded Scottish locality (Page 1988) of subsp. *latiusculum* in the company of C. N. Page and Y. C. Golding. Eight samples were taken from fronds at regular intervals across a patch c. 65m × 3m with scattered outliers. Isozyme analysis (see Sheffield, Wolf & Haufler 1989) demonstrated this to be a single genetic individual (clone). The woodland immediately behind the clone is of planted *Larix* and *Betula* and cannot be considered 'native pinewood' (cf. Page 1989). Immediately surrounding this clone are more extensive patches of a plant morphologically intermediate between it and subsp. *aquilinum* (which exists c. 30m away). Plants of this intermediate morphology have also been noted elsewhere in Scotland during intensive searches for more subsp. *latiusculum* material by C. N. Page (in litt.), FJR and others; many such samples were collected and isozymically analysed during the present study.

Nine fronds of material collected at the locus classicus of subsp. *atlanticum*, and fertile material referred to subsp. *latiusculum*, were collected by CNP and YCG and kindly made available for analysis. Gametophytes were raised from the spores of the latter; some were electrophoretically investigated, others were crossed with *aquilinum* gametophytes, and the resultant sporophytes analysed.

Two *Pteridium* fronds were also collected from each of a woodland in Grantham, New Hampshire, U.S.A., and a conifer plantation on Møn Island, Denmark, and electrophoretically analysed.

Electrophoretic analysis of 28 loci followed the methods established for *Pteridium* by Wolf (1986). (See also Wolf, Haufler & Sheffield 1987, 1988 a & b; Sheffield *et al.* 1989; Sheffield, Wolf & Haufler 1989; Wolf, Sheffield & Haufler 1990).

RESULTS AND DISCUSSION

SHOULD *PTERIDIUM AQUILINUM* SUBSP. *ATLANTICUM* BE RECOGNISED AT SUBSPECIFIC RANK?

Comprehensive isozymic analysis of material collected at the locus classicus of subsp. *atlanticum* revealed banding patterns consistent with the range of variation expressed by subsp. *aquilinum* in all samples. Although these enzymes represent only a tiny part of the genome, all *Pteridium* taxa previously investigated, which include those recognised at varietal level, have had some discrete and distinct banding pattern for at least one of the isozymes studied (Wolf 1986; Wolf, Haufler & Sheffield 1988a). We therefore conclude that recognition of subsp. *atlanticum* at subspecific level is not consistent with the other well defined *Pteridium* taxa. The basicolous nature of subsp. *atlanticum* has been strongly stressed, although without supporting evidence from soil analysis. Many authors (see Sheffield *et al.* (1989) for review) have reported *P. aquilinum* sensu stricto from base rich habitats. The morphology of subsp. *atlanticum* intergrades with that of subsp. *aquilinum* s.s. It has been suggested that such plants represent hybrids and introgressants between these taxa (Rutherford 1989). Given the acknowledged variability within the genus, we believe that final judgement on this question should be deferred until cultivation reveals whether the phenological and morphological characters described by Page (1989) are environmentally or genetically determined. Until such time, we consider that the electrophoretic evidence necessitates the reduction of subsp. *atlanticum* to synonymy with subsp. *aquilinum* var. *aquilinum*.

IS *PTERIDIUM AQUILINUM* SUBSP. *LATIUSCULUM* A BRITISH PLANT?

All of the material referred by Page (1989) to subsp. *latiusculum* possessed banding patterns for the enzymes TPI and IDH that would be expected to result from an amalgamation of the isozymes previously found in subspp. *latiusculum* and *aquilinum* (Fig.1). This strongly suggests that Scottish plants are hybrids of that parentage. Morphologically these plants more closely approach subsp. *latiusculum* but often lack marginal hairs to the pinnules and possess more or less ciliate indusia, characters considered diagnostic of subsp. *aquilinum* s.s. by Tryon (1941).

FIGURE 1. Starch gel stained for isocitrate dehydrogenase, a dimeric enzyme. Two left hand lanes, *P. aquilinum* sensu stricto from Manchester showing the most common single banded fast allele. Two central lanes, *P. aquilinum* (L.) Kuhn subsp. *latiusculum* (Desv.) C. N. Page from Scotland, showing the three banded heterozygote pattern that would result from a cross involving parents with the fast allele (lanes 1 & 2) and the slow allele (lanes 5 & 6). Two right hand lanes, *P. aquilinum* subsp. *aquilinum* var. *latiusculum* (Desv.) Underw. from New Hampshire, U.S.A. showing the most common single banded allele.

Electrophoretic analysis of the gametophytes raised from these plants showed segregation of the marker alleles (Fig. 2), as would be predicted for a plant with a diploid genetic system with disomic inheritance patterns (Wolf, Haufler & Sheffield 1987). Half the gametophytes were, as expected, electrophoretically indistinguishable from subsp. *aquilinum*, the other half indistinguishable from subsp. *latiusculum*. Gametophytes of the putative hybrid are fertile, and proved fully inter-fertile with subsp. *aquilinum*. Crosses between gametophytes from the putative hybrid with the 'latiusculum' pattern and *aquilinum* gametophytes gave sporophytes with banding patterns indistinguishable from those of the Scottish plants (e.g. Fig. 2). Cross fertilisation of gametophytes bearing the 'latiusculum' markers would reconstitute a sporophyte electrophoretically indistinguishable from subsp. *latiusculum*, as would self-fertilisation of these gametophytes. Interestingly, no such plants have been found in Scotland.

As *Pteridium* is an outcrossing species (Wolf, Haufler & Sheffield 1988b), sporophytes are routinely derived by cross-fertilization. This explains the absence of sporophytes of selfed origin but the absence of *latiusculum*-type sporophytes can only be attributed to the far higher numbers of *aquilinum* than 'latiusculum' spores (which would make crosses between *aquilinum* and 'latiusculum' far more likely than 'latiusculum' × 'latiusculum').

On morphological and phenological grounds we assume that some plants with the subsp. *latiusculum* markers represent introgressants to the subsp. *aquilinum* parent. Putative introgressants from other Scottish sites have not been analysed. In the absence of plants referred by us to subspp. *latiusculum* × *aquilinum* they must be derived either from wind-borne hybrid spores, or be relics of previous subspp. *latiusculum* × *aquilinum* or *latiusculum* populations now extinct.

FIGURE 2. Starch gel stained for isocitrate dehydrogenase. Eight left hand lanes, single gametophytes grown from spores of *P. aquilinum* (L.) Kuhn subsp. *latiusculum* (Desv.) C. N. Page showing segregation of fast and slow alleles. Two right hand lanes, sporophytes grown from gametophytes taken from the same culture, crossed with gametophytes of *P. aquilinum* sensu stricto, showing a three banded heterozygote pattern.

IS *PTERIDIUM AQUILINUM* S.S. A HYBRID OF SUBSPP. *ATLANTICUM* AND *LATIUSCULUM*?

Although *P. aquilinum* sensu stricto shows features indicative of hybridity as stated by Page (1989) (and tentative support for this has been obtained from DNA analysis for some specimens (Thomson, in litt.)), the isozymic evidence mitigates against claims that subspp. *latiusculum* and *atlanticum* can be considered potential parents.

CONCLUSIONS

The discovery of an alien genome within British material is of considerable interest. Initial investigation of Danish material attributed to var. *latiusculum* has revealed an isozyme pattern similar to that of Scottish material. European authors have shown greater reluctance than their American counterparts to distinguish var. *latiusculum* from other taxa within subsp. *aquilinum* and we agree with Page (in litt.) that non-American material may not be conspecific with var. *latiusculum* (Desv.) Underw. From the limited electrophoretic evidence currently available we hypothesise that the boreal Eurasian taxon has been derived at some stage from the hybridisation of the now European var. *aquilinum* with the now American var. *latiusculum* and that Scottish material referred by Page (1989) to the latter is best viewed as hybrid stock. This may be a native component of the British flora, or could have resulted from more recent spore dispersal from elsewhere within Europe. Subsp. *atlanticum* C. N. Page must, on current evidence, be regarded as synonymous with subsp. *aquilinum*.

The elevation of var. *latiusculum* (Desv.) Underw. to, and the creation of subsp. *atlanticum* at, subspecific rank is untenable within the currently accepted global view of the genus *Pteridium* (Tryon & Tryon 1982). Brownsey (1989) reported that hybrids between the subspecies recognised by Tryon (1941) give rise to sterile progeny (although fertile material has been obtained from one of the stands cited by Brownsey; see Tan & Thomson (1990)), whereas vars. *latiusculum* and *aquilinum* have proved to be fully interfertile. Recent chloroplast DNA analysis (Thomson, in litt.) emphasises the distinction between the essentially Southern hemisphere subsp. *caudatum* and the essentially Northern hemisphere subsp. *aquilinum*; these taxa are more distinct from one another than vars. *latiusculum* and *aquilinum*. To reflect this, and preserve a sensible infraspecific hierarchy we prefer to consider subsp. *latiusculum* (Desv.) C. N. Page at varietal level (as in Tryon 1941). Evidence is accruing that *Pteridium* is probably best subdivided into several species, and resurrection of subsp. *latiusculum* (Desv.) C. N. Page may therefore be deemed appropriate at some time in the future, but until a global monograph is completed, the uneven taxonomic treatment which currently plagues the genus should, in our opinion, be avoided.

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REFERENCES

Brownsey, P. J. (1989). The taxonomy of bracken (*Pteridium*: Dennstaedtiaceae) in Australia. *Aust. Syst. Bot.* **2**: 113–128.

Crawford, D. J. (1983). Phylogenetic and systematic inferences from electrophoretic studies, in Tanksley, S. O. & Orton, T. J., eds. *Isozymes in plant genetics and breeding*, part A, pp. 257–287. Amsterdam.

Crawford, D. J. (1985). Electrophoretic data and plant speciation. *Syst. Bot.* **10**: 405–416.

Gottlieb, L. D. (1981). Electrophoretic evidence and plant populations. *Prog. Phytochem.* **7**: 1–46.

Page, C. N. (1976). The taxonomy and phytogeography of bracken – a review. *Bot. J. Linn. Soc.* **73**: 1–34.

Page, C. N. (1986). The strategies of bracken as a permanent ecological opportunist, in Smith, R. T. & Taylor, J. A., eds. *Bracken – ecology, land use and control technology*, pp. 173–181. Lancaster.

PAGE, C. N. (1989). Three subspecies of bracken, *Pteridium aquilinum* (L.) Kuhn, in Britain. *Watsonia* **17**: 429–434.

PARIS, C., WAGNER, F. S. & WAGNER, W. H. (1989). Cryptic species, species delimitation and taxonomic practice in the homosporous ferns. *Am. Fern J.* **79**: 46–54.

RUTHERFORD, A. (1989). Atlantic bracken. *B.S.B.I. News* **52**: 17–18.

SHEFFIELD, E., WOLF, P. G. & HAUFLER, C. H. (1989). How big is a bracken plant? *Weed Res.* **29**: 455–460.

SHEFFIELD, E., WOLF, P. G., HAUFLER, C. H., RANKER, T. & JERMY, A. C. (1989). A re-evaluation of plants referred to as *Pteridium herediae* (Colmeiro) Löve & Kjellqvist. *Bot. J. Linn. Soc.* **99**: 377–386.

TAN, M. K. & THOMSON, J. A. (1990). Variation of genome size in *Pteridium*, in THOMSON, J. A. & SMITH, R. T., eds. *Bracken: biology and management*, pp. 95–103. Sydney.

TRYON, R. M. (1941). A revision of the genus *Pteridium*. *Rhodora* **43**: 1–31, 37–67.

TRYON, R. M. & TRYON, A. F. (1982). *Ferns and allied plants*. New York.

WERTH, C. R. (1989). The use of isozyme data for inferring ancestry of polyploid pteridophytes. *Biochem. Syst. Ecol.* **17**: 117–130.

WOLF, P. G. (1986). *Electrophoretic evidence for diploidy and outcrossing in the genus* Pteridium *(bracken fern)*. M.Sc. thesis, University of Kansas.

WOLF, P. G., HAUFLER, C. H. & SHEFFIELD, E. (1987). Electrophoretic evidence for genetic diploidy in the bracken fern (*Pteridium aquilinum*). *Science* **236**: 947–949.

WOLF, P. G., HAUFLER, C. H. & SHEFFIELD, E. (1988a). Maintenance of genetic variation in the clonal weed *Pteridium aquilinum* (bracken). *SAAS Bull. Biochem. Biotech.* **1**: 46–50.

WOLF, P. G., HAUFLER, C. H. & SHEFFIELD, E. (1988b). Electrophoretic variation and mating system of the clonal weed *Pteridium aquilinum* (L.) Kuhn (bracken). *Evolution* **42**: 1350–1355.

WOLF, P. G., SHEFFIELD, E. & HAUFLER, C. H. (1990). Estimates of gene flow, genetic substructure and population heterogeneity in bracken (*Pteridium aquilinum*). *Biol. J. Linn. Soc.* (In press).

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The status of *Populus nigra* L. in the Republic of Ireland

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ABSTRACT

The presence of the Black Poplar *Populus nigra* L. in Ireland is confirmed and it is shown to be locally common in rural habitats in the Midlands and along the Shannon river-system. It is suggested that *P. nigra* is an Irish native and evidence supporting this is put forward.

INTRODUCTION

The results of the B.S.B.I. Survey of the distribution of *Populus nigra* L., the native Black Poplar, in England and Wales have recently been published by Milne-Redhead (1990). I have been interested in the Black Poplar since E.M.-R. showed me some when I was staying in Suffolk in 1977, and I started to find them near my home in Dorset. I have given the Survey records from many other places in England and rediscovered the tree on Putney Heath (v.c. 17), recorded by J. Fraser in 1924 but missed by local botanists!

I have also planted out near my home in Dorset 13 seedling Black Poplars raised by E.M.-R. in 1977 from seed gathered in Cheshire, and observed their not inconsiderable genetic variation. I am, therefore, thoroughly familiar with the tree.

So, when E.M.-R. asked me to undertake a reconaissance of *P. nigra* in Ireland, I willingly agreed. Very little was known about the Irish status of this tree. A few records had come in from the Survey, including two from Co. Kildare and another from Co. Cork, but not enough to suggest a natural distribution, and none from Northern Ireland, so the map (Milne-Redhead 1990) was left blank. *Populus nigra* was not considered a native tree in Ireland by Colgan & Scully (1898). Praeger (1934), in his account of Irish vegetation, mentions that 'poplar' occurs in some areas but does not say which species. Black Poplar seemed to be most likely. But the view held by Irish botanists has been that it is a very rare, introduced tree, planted from English stock by Anglo-Irish settlers.

OCCURRENCE IN IRELAND

A circuit was planned round the Republic of Ireland south and west of Dublin. It was felt that, because of the limited time available, it would not be worthwhile to explore farther north, as the tree has a southern distribution in Britain. It seemed that the tree was most likely to be found in the low-lying fertile river-basins of the Irish Midlands, but I also had to investigate elsewhere and check several possible records. My route took me from Co. Wexford, north up the Barrow and Slaney rivers and up to Dublin. I also looked at specimens named *P. nigra* in the herbaria at **DBN** and **TCD**. Some of the specimens were obviously hybrids, but others were very clearly correctly named.

From Dublin, I travelled west to the Bog of Allen, an area of wet loamy farmland and vast lowland peat-bogs which covers much of Co. Kildare and Co. Offaly around the headwaters of the River Liffey. *P. nigra* proved to be locally common across a wide area between Edenderry and Clane, and I collected 32 records.

I then moved to the Shannon river-system and based myself at Portumna on the northern tip of Lough Derg. At Ballyshrule Bridge, just to the west of Portumna, I found *P. nigra* to be the commonest tree, but of an unusual, unbossed clone. E.M.-R. tells me that he knows of only one unbossed clone in England. However, in all other respects these trees conformed to the typical *P. nigra*. In the close vicinity of the bridge, 80 trees were recorded. Around the lake, a further 77 trees were found, with a particularly impressive group of 17 at Ballinderry on the eastern side.

FIGURE 1. Distribution of *Populus nigra* L. in Ireland.

South of Limerick, the banks of the River Maigue yielded a further eight trees, but in the Blackwater and Suir river-valleys farther south, only another four trees were found.

A map of the known distribution in Ireland is given in Fig. 1.

Contrary to existing opinion that all Irish *P. nigra* have been planted from introduced stock, only a few of these trees are associated with farmyards and farmhouses. Most of them are growing in hedges in wet farmland, often with deep, water-filled ditches draining the fields. The trees were never found in peat-bogs but always in the surrounding loamy soils. Moreover, the trees were found almost exclusively in the river-valleys and floodplains, which E.M.-R. considers to be their natural habitat in England and Wales, and rarely on hillsides.

As *P. nigra* has been considered an introduction to Ireland, it seemed probable that one method of entry of the tree into the Irish countryside might have been during the building of the extensive canal system across Ireland in the late 18th century, during the era of British domination. In Co. Kildare, I searched along a stretch of the Grand Canal south-west of Clane and discovered that the only poplars were old *P.* × *euramericana* hybrids. It appears that, as early as 1794 when this stretch was built, *P. nigra* had been replaced with cultivated hybrid trees. This seems to indicate that any introduction of *P. nigra* must have occurred before the 18th century. Furthermore, I found Black Poplars in the hedges of the pre-existing field-system, through which the canal had been built.

Older planned tree-planting would have occurred on the extensive parkland that grew up in Ireland. However, only one of the trees found could be the result of such a planting – the vast old tree near Cahir.

It seems reasonable to conclude that *Populus nigra* is a native tree of the Irish Midlands. It is not a woodland tree, so has had to survive amidst agriculture. It is almost exclusively propagated from cuttings so, as in England and Wales, relies on man's assistance. Even now it is still being planted by Irish farmers; several trees found were no more than ten years old. In Co. Galway the timber is used for joists and floorboards. I am inclined to consider the tree native because it does not appear necessarily to be associated with settlements and its distribution is very tightly linked with river-valleys and flood-plains – too closely to be haphazard introduction. The local density and distribution of the tree in Kildare and around Lough Derg is such that, if indeed the tree has been introduced, it must be an ancient introduction. But why then is this ancient introduction not concentrated along the eastern coast – the easiest point of access for English settlers and the area of densest English settlement?

It seems necessary for further research to be conducted into whether the tree is indeed native; possibly pollen analysis could provide evidence. I think it is also necessary to build up a complete picture of the distribution of the tree across Ireland; for instance, north up the Shannon river-system from Lough Derg to Lough Allen. I hope local B.S.B.I. members will carry on where I left off and not rely on visiting botanists from England or Wales. Perhaps someone will discover it in Northern Ireland.

In all, I discovered 210 trees and it appears that Ireland is a very important station for this rare and unusual species. I am confident that the status there of this tree of "rugged grandeur" (Rackham 1986), is, at the moment, secure.

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REFERENCES

Colgan, N. & Scully, R. W. (1898). *Cybele Hibernica*, 2nd ed., p. 509. Dublin.
Milne-Redhead, E. (1990). The B.S.B.I. Black Poplar survey. *Watsonia* **18**: 1–5.
Praeger, R. L. (1934). *The botanist in Ireland*, para. 239. Dublin.
Rackham, O. (1986). *The history of the countryside*, p. 207. London.

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Two new varieties of British *Dactylorhiza*

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ABSTRACT

Dactylorhiza fuchsii var. **rhodochila** D. M. T. Ettlinger, **var. nov.**, and *D. majalis* subsp. *purpurella* var. **atrata** A. J. Richards, **var. nov.**, are distinguished from typical specimens chiefly by their blotch-marked labella.

INTRODUCTION

The labellum of many species of European Orchidaceae has small purple dot or dash markings on a paler background, these being very occasionally replaced by a solid central or overall reddish-purple blotch. In most species this variation is rare and occurs only in isolated individuals, e.g. in *Corallorhiza trifida* Chatel., *Orchis anatolica* Boiss., *O. morio* L. and *O. coriophora* L. In the genus *Dactylorhiza* it seems to be more frequent, the best-known example being *D. insularis* (Sommier) Landwehr var. *bartonii* Huxley & Hunt.

This blotch marking on the labellum may be accompanied by heavier-than-average leaf spotting (e.g. in *D. fuchsii*), heavy leaf spotting where little or none is usually present (e.g. in *D. majalis* subsp. *purpurella*), and sometimes even overall suffusion of the leaves with anthocyanins (both). However, no change in leaf marking is seen in *D. insularis* var. *bartonii* or in the blotch-marked variants in *Orchis*, so blotch marking of the labellum cannot be simply an effect of heavy anthocyanin presence in the plant as a whole: some mutation in the genes that code for labellum marking seems likely to be the cause.

That this sort of variation may have evolutionary potential is indicated by the pollination advantage gained by having two colour morphs in *D. sambucina* (L.) Soó (Nilsson 1980). This species offers no reward to its bumblebee pollinators (*Bombus* spp.) and attracts them by deceit; the presence of the red var. *rubra* Winterl., in addition to the commoner yellow morph, presents an additional search pattern and extends the period before individual pollinators learn to avoid the species as a whole. For *D. fuchsii* a similar picture of deceit is clouded by the finding (Dafni & Woodell 1986) that unrewarded visits by naïve bumblebees were supplemented by visits from honeybees (*Apis mellifera*), which were to some extent rewarded by a stigmatic exudate. Nevertheless, I believe that Dafni & Woodell's study area (with which I am familiar) carried an atypically high honeybee population and there must be many *D. fuchsii* sites, e.g. in dune systems and on open downland, where honeybee presence is negligible. No similar work has been published on the pollination ecology of *D. majalis* subsp. *purpurella* but it is a reasonable assumption, in view of the high incidence of hybrids between the two where they coexist, that it is similar to that of *D. fuchsii*.

It therefore seems worthwhile to distinguish by name those examples of the blotch variation which at least occur regularly. Populations with these variants also contain typical specimens and intermediates do occur. No form of isolation seems to be involved and the rank of variety therefore seems to me to be appropriate.

Bateman & Denholm (1989) referred to three, possibly four, British dactylorchids in which a blotched variant occurs: *Dactylorhiza maculata* (L.) Soó subsp. *ericetorum* (E. F. Linton) Hunt & Summerhayes, *D. fuchsii* (Druce) Soó, *D. majalis* (Reichenb.) Hunt & Summerhayes subsp. *purpurella* (T. & T. A. Steph.) D. M. Moore & Soó, and possibly a single specimen of *D. incarnata* (L.) Soó. They mentioned without comment the already-named blotch-marked *D. maculata* var. *concolor* Vermeulen and they refrained from giving names to the others.

The analogous variety in *D. fuchsii* appears to be commoner in the British Isles than *D. maculata*

var. *concolor*, and Bateman & Denholm (1989) listed six British sites, including one of their own study areas where it formed c. 20% of the *D. fuchsii* population. To these should now be added a drain bank near Belton, N. Lincs. (Weston 1979), alkaline grassland at Blackhall Rocks, Co. Durham (M. Bradshaw 1967 per M. R. Lowe, pers. comm. 1985), a second limestone meadow in Derbys. (P. M. Torry, pers. comm. 1989), a wood on Wealden Clay near Warnham, W. Sussex (D. C. Lang, pers. comm. 1990) and the edge of a chalk beechwood near Duncton, W. Sussex (J. M. Scott per D. C. Lang, pers. comm. 1990). There can be little doubt that more sites will come to light once the taxon is formally recognised.

The blotch-marked variety of *D. majalis* subsp. *purpurella* is only known at present from one site near Hartlepool (Bateman & Denholm 1989), where a population of over 100 specimens was found in 1978 by A. J. Richards and has persisted since: plants approaching its description have been seen near Kilmore, Co. Wexford, and near Hornhead, W. Donegal, though these need confirmation (R. Piper, pers. comm. 1989).

Richards proposed the epithet *atrata* for this taxon but did not actually publish it. However, it has already become widely known on a hearsay basis and has appeared in print as a nom. illegit. (Graham 1988). To rectify this situation, A. J. Richards has kindly supplied the diagnosis of var. *atrata* below.

In both these varieties the chief distinction lies in labellum colour. Since colour cannot at present be preserved in herbaria, the obligatory holotype specimens have been supplemented by additional material in the form of photographic prints on Cibachrome made from colour transparencies; these should have a useful life in herbarium conditions of 50–100 years.

THE VARIETIES

Dactylorhiza fuchsii (Druce) Soó var. **rhodochila** D. M. T. Ettlinger, **var. nov.**
HOLOTYPUS: Beacon Hill, GR 41/608.226, N. Hants, v.c. 12, chalk grassland, 11 June 1990, *D. M. T. Ettlinger* (**K**). Additional photographic material from the same site and from near Buxton, GR 43/09.75, Derbys, v.c. 57, limestone grassland (photographs by D. M. T. Ettlinger, June 1989 and June 1984 respectively) is with the holotype in **K**, copies in **BM**.

A *D. fuchsii* differt sequentibus: folia subdensiore punctata, labellum signatum macula rhodopurpurea ad centrum cum margine pallidiore, vice punctibus linulibusque. Speciminibus extremibus pagines superiores foliarum omnino a purpureo tectae, et totum labellum atropurpureum sine margine pallida.

It differs from typical *D. fuchsii* as follows: leaves rather more heavily spotted, the labellum marked with a broad central reddish-purple area with paler edges in place of dots and small lines. In extreme examples the leaves are suffused on the upper surfaces with purple and the whole labellum is a rich dark purple without a pale margin.

Dactylorhiza majalis (Reichenb.) P. F. Hunt & Summerhayes subsp. *purpurella* (T. & T.A. Steph.) D. Moresby Moore & Soó var. **atrata** A. J. Richards, **var. nov**.
HOLOTYPUS: Locality (details withheld) in Co. Durham, v.c. 66, dune grassland, 13 July 1979, *A. J. Richards* (**BM**). Additional photographic material from the same site (photographs by D. M. T. Ettlinger, leg. A. J. Richards, 11 July 1985) is with the holotype in **BM**, copies in **K**.

A *D. majalis* subsp. *purpurella* differt sequentibus: folia grosse atromaculata, in pagine superiore maculis rotundis solidis ultra 5 mm in diametro, in pagine inferiore regulariter punctata ad margine, punctae circa 1 mm in diametro. Labellum saepe toto suffusum atropurpureum sine maculis vel linebus, aliquando cum margine pallidiore.

It differs from typical subsp. *purpurella* as follows: leaves heavily and darkly spotted, on the upper surface with solid round spots of over 5 mm diameter, on the lower surface regularly marked at the

edges with spots of c. 1 mm diameter. Labellum usually entirely suffused with dark purple without spots or lines, sometimes with a paler edge.

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REFERENCES

Bateman, R. M. & Denholm, I. (1989). A reappraisal of the British and Irish dactylorchids, 3. The Spotted-orchids. *Watsonia* **17**: 319–349.

Dafni, A. & Woodell, S. R. J. (1986). Stigmatic exudate and the pollination of *Dactylorhiza fuchsii*. *Flora (Jena)* **178**: 343–350.

Graham, G. G. (1988). *The flora and vegetation of County Durham*. Durham.

Nilsson, L. A. (1980). The pollination ecology of *Dactylorhiza sambucina*. *Bot. Notiser* **133**: 367–385.

Weston, I. (1979). A variant of *Dactylorhiza fuchsii* (Druce) Soó in N. Lincs. *Watsonia* **12**: 399–400.

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Two new species of *Cotoneaster*

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ABSTRACT

Two new species of *Cotoneaster* are described: **C. atropurpureus** Flinck & Hylmö, **sp. nov.** and **C. hjelmqvistii** Flinck & Hylmö, **sp. nov**. Both are common in cultivation and are sometimes found naturalised in the British Isles.

C. ATROPURPUREUS FLINCK & HYLMÖ

C. atropurpureus is a native of western China, but it is frequently planted elsewhere. In private gardens in the U.S.A. shrubs cultivated as *C. horizontalis* are mainly *C. atropurpureus*. In Europe *C. atropurpureus* is common in cultivation as *C. horizontalis* var. *prostratus* Hort. or as *Cotoneaster* cv. Prostratus Vilmorin (non Baker) (Grootendorst 1946). It occasionally naturalises in the British Isles (e.g. at Cambuslang, Lanarks., v.c. 77).

The holotype of *C. atropurpureus* was identified by Rehder & Wilson (1912) as *C. horizontalis* var. *perpusillus* Schneider (= *C. perpusillus* (Schneider) Flinck & Hylmö). In the Botanic Gardens of Edinburgh and Glasnevin, Dublin, there are still shrubs of *C. atropurpureus* labelled "*C. horizontalis* var. *perpusillus*, Wilson 496" – the name and number having been carefully kept for 80 years. In **AAH** there are several sheets of *C. atropurpureus* cultivated in the Arnold Arboretum as *Wilson 496* (the earliest from 1911).

Cotoneaster atropurpureus Flinck & Hylmö, **sp. nov.**
HOLOTYPUS: China, western Hupeh (=Hubei), Ichang, altitude 1300–2000 m, bare rocky ground, prostrate, fruits red, October 1907, *Wilson 496* (**A**). PARATYPUS: Cultus Bjuv, Scania, Sweden, 5 June 1967, *Hylmö 9703* (**LD**).

Ex affinitate *C. horizontalis* Decne., a quo differt altitudine majore, habitu erectiore, foliis obovatis, tenuibus, undulatis, petalis basi atropurpureis. Frutex 0·5–1 m altus, ascendens ad decumbens. Ramis primariis arcuatis; ramuli juniores distichi, initio dense luteo/flavo-villosi; ramuli annotini cinereo-fulvi, persistenter flavo-villosi. Folia praecociter decidua, 9–14 × 8–12 mm, tenuia, undulata, obovata-orbicularia, obtusa vel truncata, mucronulata, basi obtusa ad acuta; supra, clare ad obscure viridia, in gemma sparse pilosa, explicata glabra, levia; subtus pallide viridia, pilis sparsis luteis nitidis, nervis 2–3 utrinque; petioli 1–2 mm, luteo/flavo-villosi. Cymae (1–)3 florae. Pedicelli 0·2(–1) mm, pilosi. Bracteae 2 mm, subulatae, glabrae, margine villoso, rubro-violaceae. Flores erecti, 6 × 3–4 mm. Receptaculum sparse flavopilosum. Lobi calycis erecti, 1·5–2 × 1–1·5 mm, deltoidei, acuminati, sparsi pilosi, virides vel rubropurpurei, margine luteo/flavo-villoso. Petala erecta, 3·5 × 2·5 mm, inflexa, pandurata, ungui extracto, apice sub-erosa, basi atropurpurea, margine obscure rubro. Stamina 10, erecta vel incurvata, 2–3 mm; antherae albae, margine rosaceis; filamentis late subulatis, obscure rubris. Styli 2–3. Fructus 8 × 5–6 mm, obovatus,

ruber-vermicularis hollandicus, apicem versus sparse pilosus; lobis calycis oblique erectis; pyrenae 2–3.

C. atropurpureus belongs to section *Cotoneaster*, subsection *Adpressi* Hurusawa, series *Adpressi* Flinck & Hylmö. It is related to *C. horizontalis* Decne, but the leaves are larger, thinner, obovate, undulate, and fall earlier; and the petals are darker and have a purplish-black base. *C. atropurpureus* is tetraploid, with 68 chromosomes (as determined by Zeilinga (1964) as *C. horizontalis* var. *perpusilla* 13077 (**LD**), and by Hensen (1966) as *C. atropurpureus*). Its characteristics are as follows.

Shrub; decumbent to ascending, 0·5–1 m (or, if supported, to 3 m). Branches arched; young branches irregularly distichous, initially densely yellow-villous; 1-year-old branches greyish-brown, persistently yellow-villous, Leaves deciduous; lamina 9–14 × 8–12 mm, papery, slightly undulate, obovate-orbicular, apex obtuse to truncate, mucronulate, base obtuse to acute; upper surface mid/dark-green, sparsely pilose initially but becoming glabrous, veins 2–3 pairs & not impressed; lower surface pale-green, subglabrous (the hairs shining golden-yellow); petiole 1–2 mm, yellow-villous. Inflorescence a (1–)3–flowered cyme. Pedicels 0·2(–1) mm, pilose. Flowers erect, 6 × 3–4 mm. Receptacle sparsely yellow-pilose. Calyx-lobes erect, 1·5–2 × 1–1·5 mm, deltoid, acuminate, sparsely pilose, green or reddish-purple, margin yellow-villose. Petals erect & incurved (leaving no, or only a small, opening), 3·5 × 2·5 mm, fiddle-shaped, small drawn-out claw at base, apex irregularly denticulate, dark-red with purplish-black base and very narrow white marginal band. Stamens 10, erect or incurved, 2–3 mm; anthers white with margins tinged pale pink; filaments broadly subulate, dark purplish-red but white at apex (below anther). Styles 2–3. Fruits 8 × 5–6 mm, obovoid, orange-red (RHS 40A), glabrous except for sparsely pilose apex; calyx-lobes obliquely erect; nutlets 2–3.

C. HJELMQVISTII FLINCK & HYLMÖ

The taxon described in this section has been common in cultivation for more than 50 years, but various names have been used for it. An early record is a sheet in **AAH** of material cultivated in the Arnold Arboretum in 1940 as *C. racemiflorus* (Desf.) K. Koch cv. Fontanesii (*Vilmorin 353–1936*). It was initially distributed by nurseries under that appellation, and then under the wrong name *C. horizontalis* Decne. var. *wilsonii* Havemeyer ex Wilson (= *C. ascendens* Flinck & Hylmö). Subsequently it has also been sold as *C. horizontalis* cv. Coralle and cv. Robusta.

This taxon has frequently been planted in Europe, and is also cultivated in, for example, Argentina, Chile, China, and the U.S.A. It is not uncommon in cultivation in the British Isles, where it may naturalise. Its wild origin is unknown, but it is likely to be a plant of western China (where related species are native). It appears to be a wholly apomictic species, and breeds true from seed.

Cotoneaster hjelmqvistii Flinck & Hylmö, **sp. nov.**
Holotypus: Cultus Hortus Botanicus Alnarp, Sweden, 4 June 1959, *Hylmö 9300* (**LD**). Paratypus: Cultus Hortus Botanicus Alnarp, Sweden, 14 October 1958, *Hylmö 9300* (**LD**).

Ex affinitate *C. horizontalis* Decne, a quo distat habitu erectiore, altitudine majore, omnibus partibus majoribus, foliis majoribus orbicularibus tenuioribus praecociter deciduis, calyce glabro. Frutex 1–1·5 m altus, ascendens ad decumbens. Rami primarii arcuati; ramuli juniores stricte distichi, initio dense luteo- ad flavo-strigillosi; ramuli annotini badii, persistenter flavo-villosi. Folia decidua, 13–20(–25) × 10–18(–25) mm, tenuia, plana, orbicularia ad rotunde obovata (in ramulis floriferis obovata), obtusa ad apiculata mucrone pusillo, basi obtusa; supra nitentia, clare viridia (in autumno intense rubropurpurea), glabra, superficie levi, nervis 3–4(–5); subtus pallide viridia, sparse persistenter flavo-pilosa, ad nervos densius pilosa. Petioli 2–3 mm, pilosi. Cymae (1–)3(–4) florae. Pedicelli 0·5–2(–3) mm, glabri vel sparse pilosi. Bracteae 2 mm, subulatae, glabrae, margine villoso, rubro-violaceae. Flores erecti, 5 × 3–4 mm. Receptaculo glabro. Lobi calycis erecti, 2 × 1·5 mm, deltoidei, acuminati, glabri, virides vel rubropurpurei, margine luteo-villoso. Petala erecta, 4

× 4 mm, leviter incurvata, orbicularia ad obovata, ungui parum conspicuo, apice sub-erosa, rubra ad obscure rosacea, margine rosaceo. Stamina 11–14(–16), erecta, 2–3 mm; antherae albae; filamentis late subulatis, rosaceis. Styli (1–)2(–3). Fructus 8 × 8 mm, orbicularis ad obovatus, luteus, glaber; lobis calycis oblique erectis; pyrenae 2–3.

C. hjelmqvistii belongs to section *Cotoneaster*, subsection *Adpressi* Hurusawa, series *Adpressi* Flinck & Hylmö. It is related to *C. horizontalis*, but has a taller, more erect habit, is larger in all parts (the leaves considerably so), has leaves that are also thinner and fall earlier, and has a glabrous calyx. Its characteristics are as follows.

Shrub; decumbent or ascending, to 0·5–1 m (or, if supported, to 7 m). Branching distichous; branches curved at tips when young but becoming straight, persistently villous (initially dense, yellow to yellowish-white); 1-year-old branches brownish-red. Leaves deciduous; lamina 13–20(–25) × 10–18(–25) mm, thin, flat (or becoming concave), orbicular to broadly ovate (always ovate on fertile shoots), apex obtuse to mucronate, base obtuse; upper surface shining pure-green (becoming intense red-purple in autumn), glabrous, veins 3–4(–5) and not impressed; lower surface pale-green, persistently yellowish-white pilose; petiole 2–3 mm, pilose. Inflorescence a (1–)3(–4)-flowered cyme. Pedicels 0·5–2(–3) mm, glabrous or sparsely pilose. Flowers erect, 5 × 3–4 mm. Receptacle glabrous. Calyx-lobes erect, 2 × 1·5 mm, deltoid, acuminate, glabrous, green or reddish-purple, margin villose. Petals erect but slightly incurved (leaving centre open), c. 4 × 4 mm, orbicular to obovate with small claw at base, apex irregularly toothed, red to dark-rose with rose margin. Stamens 11–14(–16), erect, 2–3 mm; anthers white; filaments broadly subulate, rose. Styles (1–)2(–3). Fruits 8 × 8 mm, globose to obovoid, orange-red (RHS 40A), glabrous; calyx obliquely erect; nutlets 2–3.

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REFERENCES

GROOTENDORST, H. J. (1946). Het sortiment *Cotoneaster*. *Jaarboek de proeftuin te Boskoop*, p. 56.
HENSEN, K. J. W. (1966). Het geslacht *Cotoneaster*. *Dendroflora* **3**: 17–19.
REHDER, A. & WILSON, E. H. (1912). Rosaceae. *Plantae Wilsonianae*, p. 155. Cambridge, Mass.
ZEILINGA, A. E. (1964). Polyploidy in *Cotoneaster*. *Bot. Notiser* **117**: 262–278.

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Short Notes

A NEW SUBSPECIES OF *FESTUCA RUBRA* L.

Work carried out in this laboratory over the past 15 years has resulted in a new classification of the *Festuca rubra* L. group. The purpose of this note is to describe the only new taxon recognised.

Festuca rubra L. subsp. **scotica** S. Cunn. ex Al-Bermani, **subspecies nova**
HOLOTYPUS: Ardlamont Point, near Tighnabruaich, Argyllshire, v.c. 98, Scotland. *H. McAllister s.n.* Grown in University Botanic Garden, Leicester, 1983. *C. A. Stace F157* (**LTR**).

Planta rhizomatosa; culmi sparsim fasciculosi usque ad 70 cm alti; panicula densa ramis strictis; spiculae (ad apicem quarti flosculi) (8) 9·4–11·8 (12·5) mm longae; lemmata basalia (5·5) 6·1–7·9 (9) mm longa cum arista (0·3)1·2–2·3(3·7) mm longa; folia innovationum involuta, fasciculis sclerenchymae parvis discretis; chromosomatum numerus 2n=56.

This subspecies is distinguished from most taxa within the *F. rubra* group by its long spikelets, rather long lemmas, and long awns. *F. rubra* var. *commutata* Gaudin (*F. nigrescens* Lam.) has equally long awns, but the spikelets and lemmas are shorter and the plant lacks rhizomes. *F. rubra* subsp. *multiflora* Piper (*F. diffusa* Dumort., *F. heteromalla* Pourret) has equally long spikelets and lemmas but the panicle is very diffuse, the culms usually much taller (often 1 m tall), and the leaf-blades are flat. *F. juncifolia* St Amans also has equally long spikelets and lemmas but the culms are not tufted, the rhizomes are much longer, and the innovation leaf-blades have continuous or nearly continuous abaxial sclerenchyma.

F. rubra subsp. *scotica* is a boreal taxon; outside Scotland we have seen material from Scandinavia (including Iceland), and it is likely to occur more widely. In Scotland it occurs in a range of grassy, usually wet, habitats, from near sea-level to at least 825 m in the mountains. It is found from the type locality in Argyllshire northwards to North Mainland, Shetland Isles, and Lewis, Outer Hebrides.

The only other taxon within the *F. rubra* group that has a similar distribution is *F. rubra* subsp. *arctica* (Hackel) Govoruchin (*F. richardsonii* Hook.), but the latter has shorter spikelets and lemmas which are usually glaucous and densely covered with white hairs and have usually very short (or no) awns, and is hexaploid (2n=42). *F. rubra* subsp. *scotica* is evidently either octoploid (2n=56) (type specimen; plant from Iceland) or decaploid (2n=70) (plant from Torridon, W. Ross).

This taxon was first recognised by C. E. Hubbard as characteristic of high altitudes in the Cairngorms (see Webster (1978, p. 489) and Hubbard (1984, p. 374), where it is called "subsp. (ex Cairngorms)"), but he did not name it. It was also recognised as a distinct taxon by S. M. Cunningham, working in Leicester in 1979–82, and he provisionally named it subsp. *scotica* and determined specimens from outside the Cairngorms (see Scott & Palmer (1987, p. 352)); he did not formally describe it. We have now grown it at Leicester for many years and confirmed its distinctness.

Further details of morphology, anatomy, cytology and distribution will follow in a later paper, as will the results of hybridisation experiments.

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REFERENCES

HUBBARD, C. E. (1984). *Grasses*, 3rd ed. revised by J. C. E. Hubbard. Harmondsworth.
SCOTT, W. & PALMER, R. (1987). *The flowering plants and ferns of the Shetland Islands*. Lerwick.
WEBSTER, M.McC. (1978). *Flora of Moray, Nairn and East Inverness*. Aberdeen.

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ABNORMAL FLOWERS IN *PLATANTHERA CHLORANTHA* (CUSTER) REICHENB. AND *GYMNADENIA CONOPSEA* (L.) R.BR. SUBSP. *CONOPSEA*

On 7 July 1989, a plant of *Platanthera chlorantha* (Custer) Reichenb. was found in flower near Dent in N.W. Yorks., v.c. 65. It had 19 flowers but only the uppermost one was abnormal. The height of the plant was 30 cm. The column, median outer perianth segment and lateral inner perianth segments of this abnormal flower were normal, but the lateral outer perianth segments were absent. The labellum was sepaloid, and without a spur. The dimensions of the labellum were 4·6 × 9·3 mm; it was shallowly deflexed, curled up at the distal end and trilobed. It was white with some light green at the tip and very light green veins.

The sepaloid nature of the labellum of this abnormal flower is of particular interest because it bears a striking resemblance to those featured in Plate 2 and Figs. 1A & B of McKean's (1982) description of the supposed intergeneric hybrid, × *Pseudanthera breadalbanensis* McKean (*Platanthera chlorantha* × *Pseudorchis albida* (L.) Á. & D. Löve). In × *P. breadalbanensis* all the flowers are similar (McKean 1982), each having a labellum similar to that of the abnormal *P. chlorantha* flower found at Dent. In the author's opinion, × *P. breadalbanensis* is not a hybrid but an abnormal variant of *P. chlorantha*, for the following reasons. Firstly, the labella are similar to the labellum in the abnormal Dent flower. Secondly, the only morphological features of *Pseudorchis albida* evident in × *P. breadalbanensis* are the trilobed labellum and the flower length; the latter, however, merely reflects the former, and thus there are no intermediate features requiring a hybrid explanation. Thirdly, there is abundant evidence of the frequency of floral abnormalities in *P. chlorantha*. Hemsley (1907) wrote that in "*P. bifolia* in the broad sense, that is including *P. chlorantha*, many deviations from the typical floral structure are on record, . . .". This is borne out by Camus & Camus (1929). Only a few of the abnormalities observed in *P. chlorantha* need be mentioned. Flowers with no spur, two spurs and three spurs were found to be sufficiently frequent to be given names: *ecalcarata* (Druce 1921; Godfrey 1933), *bicalcarata* (Camus & Camus 1929) and *tricalcarata* (Hemsley 1907) respectively. These abnormalities were variously accorded the rank of variety, form and *lusus*. Hemsley (1907) reported that "True peloria of two kinds has been observed in *Platanthera*, namely lip-peloria and petal-peloria, in which the transformed organs, being of the petal series, are either like the lip or the lip takes the shape and colouring of the other two petals". Camus & Camus (1929) specifically referred to the former kind of peloria in *P. chlorantha*. Thus, types (a) and (b) peloria *sensu* Bateman (1985) have been observed in *Platanthera*. Interestingly, Henslow (1858) reported a plant of *P. chlorantha* in which only the lowest flower was abnormal, although only approximately half the inflorescence was expanded. The flower was abnormal in that the median outer perianth segment was united with one of the lateral outer perianth segments, and instead of the usual two anther-lobes, there were four. The fourth reason for preferring a peloric interpretation of × *P. breadalbanensis* derives from the five observations made by Bateman (1985). Fifthly, of the habitat of the alleged hybrid McKean (1982) remarked "A site with so many plants of *Platanthera chlorantha* as well as several specimens of *Pseudorchis albida* must be very rare in Britain." On 7 July 1985 at the Dent site over 200 flowering spikes of *P. chlorantha* were counted in the corner of the hilly pasture where the abnormal flower was found. On 28 June 1986, at the same site, six flowering spikes of *P. albida* were found just above this concentration. This is the only such site known to the author in Watsonian Yorkshire (v.cc. 61–65 inclusive). That similar labella should appear at similar sites, one labellum undoubtedly not the product of hybridisation, would seem to be significant.

The mounted labellum of the abnormal flower of *P. chlorantha* found at Dent has been retained by the author.

The next example of an abnormal orchid flower illustrates the more common situation where all the flowers in an inflorescence are similarly and clearly abnormal.

A plant of *Gymnadenia conopsea* (L.) R.Br. subsp. *conopsea* with abnormal flowers was found on 14 July 1989, near Rievaulx in v.c. 62, N.E. Yorks. All the flowers in the inflorescence were abnormal in exactly the same way. The labellum, the inner lateral perianth segments and the outer median perianth segments were normal. The outer lateral perianth segments were abnormal in that they were folded forward, not spread horizontally or downwardly curved. Further, their margins were not revolute.

Clapham (1987) said of the genus *Pseudorchis* "Close to *Gymnadenia* but with the outer lateral perianth segments connivent with the outer median and the inner perianth segments into a hood so that the flower becomes almost campanulate". The plant found near Rievaulx thus had flowers with features common to both genera. To my knowledge, no other members of sub-tribe, Gymnadeniinae (which includes *Platanthera*, *Pseudorchis* and *Gymnadenia*) have been recorded from this site. However *G. conopsea* subsp. *densiflora* (Wahlenb.) G. Camus, Bergon & A. Camus is not uncommon here. Camus & Camus (1929) commented that abnormalities in *G. conopsea* are frequent.

REFERENCES

Bateman, R. M. (1985). Peloria and pseudopeloria in British orchids. *Watsonia* **15**: 357–359.

Camus, E. G. & Camus, A. (1929). *Iconographie des Orchidées d'Europe et du Bassin Méditerraneen* **2**: 382–3, 405–6. Paris.

Clapham, A. R. (1987). *Pseudorchis albida* (L.) Á. & D. Löve, in Clapham, A. R., Tutin, T. G. & Moore, D. M. *Flora of the British Isles*, 3rd ed., p. 570. Cambridge.

Druce, G. C. (1921). New county and other records. *Rep. botl Soc. Exch. Club Br. Isl.* **6**: 399.

Godfery, M. J. (1933). *Monograph and iconograph of native British Orchidaceae*. Cambridge.

Hemsley, W. B. (1907). *Platanthera chlorantha* Custer var. *tricalcarata* Hemsl. *J. Linn. Soc. Lond. (Bot.)* **38**: 3–5, t. 1.

Henslow, J. S. (1858). On a monstrous development in *Habenaria chlorantha*. *Proc. Linn. Soc. Lond. (Bot.)* **2**: 104–105, t. IB.

McKean, D. R. (1982). × *Pseudanthera breadalbanensis* McKean: a new intergeneric hybrid from Scotland. *Watsonia* **14**: 129–131.

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A NONRESUPINATE ABNORMALITY IN *ORCHIS PURPUREA* HUDSON

Rose (1948) described peloria in *Orchis purpurea* Hudson in Kent and various floral abnormalities have since been described. Ettlinger (1987) has drawn attention to a group of *O. purpurea* on a nature reserve in E. Kent (v.c. 15) displaying various degrees of peloria and nonresupination. We report a different nonresupinate abnormality without peloria, from the same nature reserve, of which we have been unable to find a previous description.

A single plant was observed in flower in 1986, 1987 and 1988 and was consistently abnormal in each year. It failed to appear in 1989 and 1990. Each flower was completely inverted; the peduncular ridges were not spiralled, showing that resupination had not occurred. The usual floral parts could be identified, including pollinia, but the flowers, the inflorescence and the rosette leaves were all narrower than in associated normal plants (Fig. 1 and Table 1). Seed capsules did not mature in any year. However, seed-set was patchy among normal plants on the reserve.

The complete failure to set seed might be due to the difficulty facing pollinating insects when attempting to settle on the inverted flowers and, in any event, they would probably fail to place the pollina from normal flowers on the stigmatic surfaces of the nonresupinate forms. The abnormality might be explained by the loss of a fragment of DNA carrying the gene for resupination and some accessory gene(s) controlling robust growth.

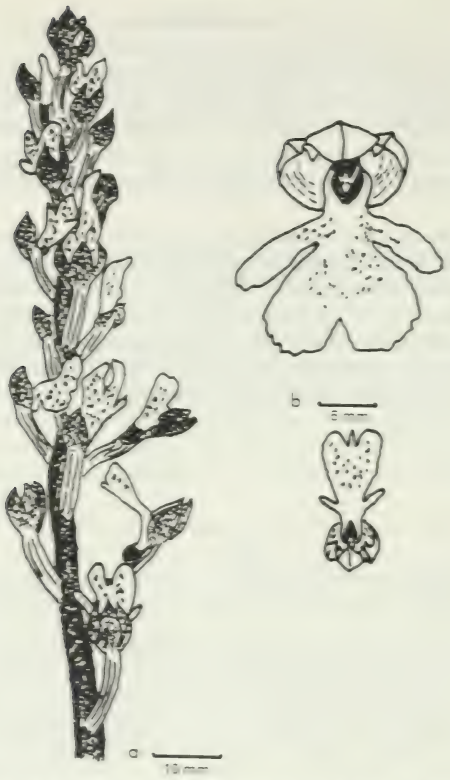

FIGURE 1. a) The flowering spike of the nonresupinate plant (traced from a photograph). Note the rectilinear peduncular ridges. b) Individual florets from a normal (above) and the abnormal plant. The abnormal flower was drawn from a specimen preserved in spirit.

TABLE 1. COMPARISON OF NORMAL AND NONRESUPINATE PLANTS OF *ORCHIS PURPUREA* HUDSON

Character[a] (dimensions in cm)	Nonresupinate plant	Normal plants on the same reserve			
		n	mean	range	S.D.
Height of flowering stem	35	8	47·3	39–56	5·87
Inflorescence					
height	12·5	8	14·1	10–22	3·73
diameter	2·5	8	5·3	4·5–7·0	0·76
no. of flowers	30	8	35·9	28–49	7·94
Width of flower[b]					
across 'arms'	0·9	12	1·38	1·0–2·0	0·33
across 'skirt'	0·5	12	1·28	0·9–1·7	0·26
Rosette leaves[c]					
length	13, 14, 13	16	15·3	11–19	2·23
width	3·5, 3·5, 3·5	16	5·0	4·3–6·3	0·52

[a] Plants were measured when all but the top 2–3 flowers were fully open.
[b] A single flower was measured on 12 different plants; dimensions appeared relatively constant for a given plant.
[c] Three leaves were measured on the nonresupinate plant, but only two on each normal plant.

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We are grateful to D. C. Lang for drawing the florets and for with help in presenting this note; to A. C. Jermy and J. J. Wood for bibliographic help; and to Mrs Peter Morgan for translation of a Dutch article. We thank the Kent Trust for Nature Conservation for permission to take material for study and to publish.

REFERENCES

ETTLINGER, D. M. T. (1987). Peloric and duplex examples of *Orchis purpurea* Hudson in Kent. *Watsonia* **16**: 432.
ROSE, F. (1948). *Orchis purpurea* Hudson. *J. Ecol.* **36**: 366–377.

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HERBARIUM SHEETS OF THE RARE FERN × *ASPLENOPHYLLITIS MICRODON* (T. MOORE) ALSTON IN EDINBURGH

Two previously unknown Victorian herbarium sheets of the rare Guernsey Fern (× *Asplenophyllitis microdon* (T. Moore) Alston) have recently come to light at the herbarium of the Royal Botanic Garden, Edinburgh. In excellent condition, the two sheets (both originally ex herb. Neill Fraser, from whom they were purchased in 1905) include at least five separate gatherings made between the years 1860 & 1865, containing a total of ten beautifully preserved fronds, varying from 15 to 26 cm in length.

This unusual intergeneric hybrid fern between Lanceolate Spleenwort (*Asplenium billotii* F. W. Schultz) and Hart's Tongue Fern (*Phyllitis scolopendrium* (L.) Newm.) has always been of limited wild occurrence. First found in Guernsey in 1855, it was subsequently known to occur in the mid-19th century sporadically in Cornwall, Devon and possibly Wales (Alston 1940), while more positive records of it came from Guernsey through the latter half of the 19th century, where it still survives (McClintock 1968, 1975). It is illustrated as silhouettes in Page (1982: 129), and as field photographs in Page (1988: 131 & 132). The two newly-found Edinburgh sheets appear to include specimens from both Guernsey and Cornwall.

As might be expected of a hybrid between two such morphologically differing parents, the frond form of the hybrid is variable between specimens. Previously-known original Victorian herbarium material (at **BM** and **K**) of this fern is sparse, and amounts to less in total than these new finds. The discovery of these well-preserved Edinburgh sheets thus not only doubles the amount of known herbarium material, but also helps add substantially to our knowledge of the variation pattern.

REFERENCES

ALSTON, A. H. G. (1940). Notes on the supposed hybridisation in the genus *Asplenium* found in Britain. *Proc. Linn. Soc. Lond.* **152**: 132–144.
MCCLINTOCK, D. (1968). Plant notes: *Asplenium billotii* × *Phyllitis scolopendrium* = × *Asplenophyllitis microdon* (T. Moore) Alston. *Proc. Bot. Soc. Br. Isl.* **7**: 387–389.
MCCLINTOCK, D. (1975). *The wild flowers of Guernsey*. London.
PAGE, C. N. (1982). *The ferns of Britain and Ireland*. Cambridge.
PAGE, C. N. (1988). *Ferns. Their habitats in the landscape of Britain and Ireland*. London.

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A NEW SUBSPECIES OF *GYMNADENIA CONOPSEA* (L.) R.BR.

Gymnadenia conopsea (L.) R. Br. subsp. **borealis** (Druce) F. Rose, **comb. et stat. nov.**
Habenaria gymadenia Druce var. *borealis* Druce in *Rep. botl Soc. Exch. Club Br. Isl.* **5**: 172 (1918).

Gymnadenia conopsea var. *borealis* (Druce) Godfery, *Mon. Icon. Br. Orchidaceae* 143 (1933).
G. conopsea var. *insulicola* Heslop-Harrison in *Proc. Univ. Durham Phil. Soc.* **10**: 260 (1941).
G. odoratissima auct. angl., non (L.) Rich. (1817).

A compact plant with small, dark-pink to purple flowers; labellum about twice as long as broad, much less divided than in subsp. *conopsea*, though middle lobe broader than the lateral; sepals oval, acute. Flower scent strong, reminiscent of cloves. Flowering July and August.

Hill pastures up to 700 m, which may be acid, and apparently the predominant subspecies from Scotland southwards to Derbyshire, but also locally in Devon and Cornwall, and in the New Forest, Hampshire, in base-rich flushes, and one site in Ashdown Forest, Sussex.

A full account of the taxonomy of *G. conopsea* is in preparation.

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NEW NAMES AND COMBINATION FOR THREE HYBRIDS

Opinions differ over the use of names as opposed to formulae for interspecific hybrids, but where the hybrid has a distribution pattern independent of that of its parents, due to natural or man-assisted spread, it surely demands a name in its own right. The following fall into this category.

Atriplex × taschereaui Stace, **hybrida nova**
Holotypus: Beckfoot, Cumberland, v.c. 70, England. Occasional on exposed coastal beach, 23 September 1978, *P. M. Taschereau s.n.* (**LTR**).

Hybrida fertilis inter *A. glabriuscula* Edmondston et *A. longipes* Drejer. Ab *A. glabriuscula* bracteolis nonnullis ad 20 mm longis, pedicellatis ad 10 mm, herbaceis apicibus differt. Ab *A. longipes* bracteolis connatis in dimidio inferiore, pedicellatis ad 10 mm differt. Ab *A.* × *gustafssoniana* Taschereau (*A. longipes* × *A. prostrata*) bracteolis connatis in dimidio inferiore differt.

Most plants are similar to *A. glabriuscula* in vegetative characters, but differ in at least some bracteoles being up to 20 mm long, herbaceous at the apex and with pedicels up to 10 mm long. The hybrid differs from *A. longipes* and other hybrids involving that species in having its bracteoles united at the base for up to half their length. *A. longipes* itself has even larger bracteoles (up to 25 mm) with longer pedicels (up to 25 (30) mm).

A. × *taschereaui* is named in honour of Dr Pierre Taschereau, who not only collected the holotype but has contributed much to our knowledge of this genus in Britain. Taschereau (1989) has provided a more detailed description and a drawing of this hybrid, which occurs on exposed beaches in Scotland, northern England and the Isle of Man, usually (but not always) with *A. glabriuscula* but usually without (and commoner than) *A. longipes*.

Mahonia × decumbens Stace, **hybrida nova**
Holotypus: South of Newmarket to Cambridge road, West Suffolk, v.c. 26, England. In shady beech plantation, 2 July 1973, *D. M. McClintock s.n.* (**BM**).

Hybrida (? fertilis) inter *M. aquifolium* (Pursh) Nutt. et *M. repens* (Lindley) Don. A *M. aquifolium* foliolis (3–)7, hebetatis, minus quam duplo longioribus quam latis differt. A *M. repens* foliolis 4–8 cm longis, plus quam 1·5-plo longioribus quam latis differt.

This hybrid is closer to *M. repens* in habit, having procumbent, stoloniferous stems rarely more than 30 cm high and leaflets with a matt upper surface, but the leaflets are 4–8 × 2·4–4·5 cm (1·5 to 2 times as long as wide) with 8–11 teeth on each side.

This hybrid is a garden plant (often mis-named *M. repens*) to which several cultivar names refer.

Some untypified binomials might be applicable to this hybrid, but N. P. Taylor (Kew) has kindly advised me (in litt. 1989) ". . . if you really need a binomial I recommend you to publish a new name. The typification of the earlier names is too problematic and uncertain". It is planted as ground cover, which is the origin of the Newmarket population, where it has been known for many years.

Doronicum × **excelsum** (N.E.Br.) Stace, **comb. et stat. nov.**
D. plantagineum var. *excelsum* N.E.Br. in *Gard. Chron.*, ser. 2, **20**: 230 (1883).

This taxon is of garden origin, its most likely parentage being *D. columnae* Ten. × *D. pardalianches* L. × *D. plantagineum* L., as suggested by Leslie (1981).

REFERENCES

Leslie, A. C. (1981). A note on naturalized *Doronicum* in Britain. *B.S.B.I. News* **27**: 22–23.
Taschereau, P. M. (1989). Taxonomy, morphology and distribution of *Atriplex* hybrids in the British Isles. *Watsonia* **17**: 247–264.

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Book Reviews

Flora of the East Riding of Yorkshire. E. Crackles. Edited by R. Arnett. Pp. xii+271, with 5 text figures, 41 colour plates and 465 distribution maps. Hull University Press and Humberside County Council. 1990. Price £30 (ISBN 0–85958–487–9).

The publication of Eva Crackles' Flora of the East Riding is the most important event in Yorkshire botanical literature since the appearance of the last *Flora of the East Riding of Yorkshire* by J. F. Robinson in 1902. Since then there have been accounts of the plants of smaller parts of the county but never a full vice-county flora. The present work is the culmination of a lifetime's interest and 40 years of systematic recording by Miss Crackles and fellow field botanists. It has been edited by Roger Arnett, a lecturer in the School of Geography and Natural Resources at Hull University. He also produced camera-ready copy for the printers.

In his foreword Professor C. A. Stace states: "Clearly the Flora will immediately become the authoritative and indispensable source of floristic data concerning the East Riding".

Part I of the Flora comprises:
1) a definition of the area covered, which is divided into four geographical regions, namely Upper Derwentland, The Vale of York, The Wolds and Holderness;
2) a comprehensive chapter on geology and soils written by Dr Arnett;
3) a historical section on botanists and earlier publications;
4) an interesting chapter on habitats with examples of sites and the plants therein;
5) an explanation of the distribution patterns shown on the maps;
6) a short chapter emphasising the need for conservation.
Part II is composed of the systematic part of the Flora and the distribution maps. Only vascular plants are dealt with.

For each species we are given the date of the first record, its status, habitat and frequency in v.c. 61, and a code to indicate its European distribution where it was felt that this would be instructive. For records of uncommon species the name of a nearby village is given along with the date and the initials of the recorder. Changes in frequency are indicated. Details of critical species are given where they have been determined by specialists. Publications and herbaria cited in the flora are listed, as are recorders. The excellent photographs of habitats and plants are nearly all Miss Crackles' own.

An innovation in this Flora is that some of the maps are arranged in sets according to the habitat requirements of the plants. Maps of very common and very rare plants are omitted, but there are 200 additional maps which show interesting distribution patterns. Overlays are provided to show altitude; chalk and limestone; sand or gravel; clay; rivers, canals and lakes; springs; built-up areas; disused railways. However, their value is somewhat diminished by the fact that the dots on them obscure the dots on the maps.

Criticisms are few. There is the occasional typographic error. *Parapholis incurva* is not at its "absolute northern limit" at Spurn. Perhaps it is not well known that it also occurs in Northumberland. One might also quibble with the statement that *Carex paniculata* "requires highly alkaline conditions". Outside the East Riding, it thrives in sites over millstone grit and, even allowing for a thin cover of clay till which may possibly include a few, small limestone erratics at one site, the conditions are by no means highly alkaline.

Nevertheless, this splendidly produced, informative book will rank amongst the best of the recent, large format vice-county Floras and may act as both a spur and a daunting challenge to the other Yorkshire vice-county recorders.

Miss Crackles has expressed a hope that this will be a flora that will be used. Its size will prevent its being taken into the field and some may be deterred by the price from buying it for themselves but,

as the standard work of reference, it will be removed frequently from library shelves and enjoyed by all those who have an interest in the flora of south-eastern Yorkshire.

P. P. Abbott

The herbarium handbook. Edited by L. Forman & D. Bridson. Pp. iv+214, with numerous illustrations. Royal Botanic Gardens, Kew. 1989. Price £12 (ISBN 0–947643–20–6).

This new handbook certainly fills an important gap on the bookshelf. It provides information which until now was only available by asking experienced herbarium staff. All important herbarium techniques are dealt with in a clear and easy way, from the mounting and labelling of specimens to organizing and cataloguing a collection, and discussing modern techniques like the use of a computer data base. There are special chapters on the curation of groups that need special treatment like pteridophytes, bryophytes, fungi and lichens, and the management of a spirit collection has also been described. As the book is mainly based on the techniques used at Kew it does not always give the whole range of options available. For example, the possibility of freeze-drying fungi is not mentioned, although this is a fairly easy way of preservation which for some groups can give very good results.

However, this small book is more than just a herbarium handbook. It also covers many aspects related to the work in a herbarium, like collecting specimens or illustrating and photographing plants. Furthermore it is a very friendly reference book, providing most useful information one ever so often tends to forget, such as the meaning of Latin abbreviations or dates written in Roman numerals, or the difference between a holotype and a syntype. To make it even more useful the index could have been a little more detailed, and maybe important page numbers printed in bold would have helped to save searching. Nevertheless it is an excellent book and these very minor points of criticism should not obscure its merits.

It is undoubtedly essential for all herbarium staff but also very valuable for anybody who is interested in collecting and preserving plants. To me it is a most helpful guide which I would not like to have to do without.

H. Hofmann

Spartina anglica – *a research review*. Edited by A. J. Gray and P. E. M. Benham. Institute of Terrestrial Ecology & H.M.S.O., London. 1990. Price £8 (ISBN 0–11–701477–X).

The story of *Spartina anglica* is now well-known – a vigorous and fertile plant with immense abilities to invade large areas of estuarine mudflat. Since evolution from a sterile hybrid in the late 19th century it has spread to many intertidal areas in the temperate zone.

This review combines some new material with the proceedings of a conference held in 1985. The story of *S. anglica* unfolds through a series of complementary papers dealing with its biogeography, ecology and genetics. The volume covers the sensitivity of the species to oil pollution and heavy metals and considers its productivity and possible uses as a bio-fuel. The dilemma for mankind (*S. anglica* – friend or foe) is covered in the final inconclusive paper dwelling on the advantages of this highly successful plant for land reclamation and prevention of erosion against the disadvantages of the swift and fundamental changes that the plant can bring to estuaries of national and international value for birds.

Although tending towards the academic, the botanist will find much in this volume of interest, but a more detailed examination of the impact of *Spartina* on substrate, and on mud-dwelling invertebrates, would have been a welcome addition. A more holistic view of the overall impact of *S.*

anglica and a glimpse of the likely future spread both of the species and its associated 'die back' would have been informative.

P. Rothwell

Plant names of medieval England. A. Hunt. Pp. 400. Boydell & Brewer Ltd., Woodbridge. 1989. Price £35 (ISBN 085991–266–3).

Popular medicine in thirteenth century England. A. Hunt. Pp. xii+476. Boydell & Brewer Ltd., Woodbridge. 1990. Price £39.50 (ISBN 085991–290–6).

With these two books Tony Hunt establishes a new reference point for vernacular plant taxonomy in 13th–15th Century England. Those interested in medieval herbals or vernacular names will want to have *Plant names of medieval England* on their shelves. Making progress in this field is like grasping smoke, and this book should be used with caution. Hunt comes to this field as a scholar of Anglo-Norman French and botanists will question many of his identifications, even though the standard is high. Hunt's achievement is to distil the Latin nomenclature of 64 texts dated between 1280 and 1500, with their associated vernacular glosses, into the easily digestible form of *Plant names*. He has started more lexical hares than he has caught, but for that we should be grateful.

The introduction to *Plant names* sketches the problems of such a study and lists the sources, with a thorough bibliography. The main body of text is a dictionary of the Latin or Greek names in alphabetical order: Abaligustra, Abies, Abitumon, etc., as they appear in medieval herbals. Under this is the botanical identification, and the English names that gloss the Latin: *Abies* = fir-tree, etc. Herein lies the main problem of the work, an over-reliance on medieval Latin names over English vernacular. Some English names are found as glosses for many medieval Latin names, for instance 'mugwort' (for 22). Hunt concludes that they are polysemous, which they are not. Mugwort has, since Anglo-Saxon times, meant only one thing to an Englishman, *Artemisia vulgaris*. It is the Latin names which are polysemous. It seems to me that this polysemy has a consequence of tremendous importance: out of it comes the concept of the genus, alien to the almost totally uninomial folk taxonomies of Europe. For instance, in trying to interpret the Latin uninomial 'Consolida', confused herbalists applied it to several different plants, and to resolve this confusion, these were later distinguished as Consolida major (*Symphytum officinale*), Consolida media (*Chrysanthemum leucanthemum*) and Consolida minor (*Bellis perennis*). The idea of genus and epithet so established led directly to the Linnaean binomial system.

Hunt repeats the blunder (*pace* Grattan & Singer, *Anglo-Saxon magic & medicine* (1952, p. 87) and Earl, *English plant names from the tenth to the fifteenth century* (1880, p. 5)) of associating 'bothen' with *Rosmarinus officinalis*. The Anglo-Saxon 'bothen' (later corrupted to bothel) means only one plant, *Chrysanthemum segetum*, although it has been applied to other weedy Compositae, as in white bothen for *Chrysanthemum leucanthemum* (in the appendix of Gerard's Herbal) and blue bothen for *Centaurea cyanus* (hence bluebottle). There are some details that might make a botanist blanch, such as Pulegium montanum identified as *Thymus serpyllum*, not *Thymus pulegium* or *Thymus* spp., and for that matter the persistent use of 'ssp.' when 'spp.' is intended. Likewise the Index of Botanical Names is irritating with the initial of every epithet capitalised.

The author touches upon, but does not solve, the problem of polarity in translation names. For instance, is Oculus Bovis just a translation of ox eye (*Chrysanthemum leucanthemum*), or is it the other way round? The existence of a good Anglo-Saxon name, meadwort, for this plant leads me to suspect that ox eye has never been more than a translated book-name. The 19th century flora writers who were so indefatigable in coining pseudo-vernacular book-names, may just have been at the head of a long line.

In *Popular medicine* Hunt gives a picture of 13th century botany (indistinguishable from medicine at this date). In the preface he draws attention to the fact that 80 per cent of the world's population relies still on popular medicine, and thus the study of vernacular herbalism is far from being an irrelevance. The introduction is the most interesting part of this book for the general reader, covering the history, form and content of the medical receipt from Babylonian times to the 13th

century, the preparation of compound medicines, collection of herbs, weights and measures and the archaeological evidence.

After the introduction there follow 272 pages of well edited medieval texts. For the first time these works can be studied with the problems of palaeography and lexis largely removed. The reader is saved from laziness however, as no translations from the Latin, Anglo-Norman French or Middle English are provided – to do so would have unreasonably increased the bulk and price of the book. There follow 127 pages of notes and glossaries. Not all the botanical information is correct. Bresil/ Brasile (pp. 202 & 309) is absurdly glossed as *Sequoia sempervirens*, when it is actually *Caesalpinia sappan*, imported from the East Indies. For a big book the index is slight.

Q. C. B. Cronk

Atlas Florae Europaeae, Volume VIII: Nymphaeaceae to Ranunculaceae. Edited by J. Jalas & J. Suominen. Pp. 261. Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vanamo, Helsinki, Finland. 1989. Price 460 Finnish Marks (ISBN 951–9108–07–6).

Chorology, the study of the geographical distribution of species on the earth's surface, is nowadays a more exact science than our Victorian counterparts knew. In particular, the spread of dot grid mapping continues to provide objectively justifiable maps for botanists and zoologists in many fields. None of these mapping projects is more impressive than the *Atlas Florae Europaeae*, begun as an international cooperative offshoot of the *Flora Europaea* project in 1965, and administered from Helsinki. The previous seven volumes, covering Pteridophyta, Gymnospermae and the beginning of the Angiospermae, appeared between 1972 and 1986, and were reprinted as a compendium in three volumes by Cambridge University Press in 1988. The arrangement of the work follows that of *Flora Europaea* itself.

It is now 26 years since the first volume of *Flora Europaea* was published, and in many respects the text of this first volume is known to be out of date and needing modification in the light of newly published work. One of the strengths of the *Atlas* project is that the editors have consistently not only indicated where their treatment differs from that of *Flora Europaea* but have also given chapter and verse for that difference. Since the *Atlas* is still, in this eighth volume, only dealing with families in the first volume of *Flora Europaea*, it is not surprising to find quite large changes, both taxonomic and nomenclatural, between the two works. The volume is very largely devoted to the family Ranunculaceae, and many familiar British plants are naturally featured. As an example of change, the *Atlas* gives ten subspecies of *Aconitum napellus*: these correspond roughly with the '*A. napellus* group' of five species in *Flora Europaea*, and the British plant, mapped in the *Atlas* under the name of *A. napellus* subsp. *napellus*, is indicated as almost, but not quite, endemic to Britain, with a single dot in south-western France. The widespread plant of northern France is separately mapped as subsp. *lusitanicum* Rouy.

In avowedly critical groups, the *Atlas* is often commendably frank. Thus, the maps of Batrachian *Ranunculus* taxa are prefaced by a carefully-phrased warning that concludes as follows: "Nevertheless, we consider that the . . . maps below, with all their faults and unevenness, are more informative than collective maps and more useful for future research . . .", a sentiment with which I feel sure most users will agree.

The remarkably high standard of production achieved so far in the *Atlas* has been fully maintained in this volume. In particular, the excellent paper means that the maps are reproduced with perfect clarity. As for minor proof-reading errors, I can only report that I have yet to find a single one, though I have referred to many pages.

It is perhaps a pity that no information accompanies this volume as to the future intentions, in collaboration with Cambridge University Press, of continuing the publication in compendium form. A quick calculation based on *Flora Europaea* pagination suggests that the now published volume 8 of the *Atlas*, together with the four projected volumes, would conveniently fit into another three volumes of the compendium. Before the end of the century, European botanists can confidently expect a completed companion *Atlas* to *Flora Europaea* volume 1. But by then, it is rumoured, we shall have a brand new second edition of that F. E. volume, so presumably the process can start again!

In the Preface, the editors express confidence that the project will keep to its schedule to finish mapping all the taxa in Volume 1 of *Flora Europaea* by 1995, and indicate that this will require four more volumes. All European botanists will wish them success!

S. M. WALTERS

Plants of Upper Teesdale. C. Lowe, with contributions from M. Lowes & G. Ward. Illustrations by J. Fielding. Pp. ix+75, with 50 line drawings and 1 map. Privately published. 1990. Price £4.75 by post from Chris Lowe, 4 Brick Kiln Cottages, Boxford, Colchester, Essex, CO6 5NT.

Responsibly excluding the National Nature Reserve (apart from the Cow Green Nature Trail) and all plants not accessible by path, this book understandably had difficulty in meeting an apparent target of 50 'Teesdale specialities'. Indeed, only 35 such species are included. The objective, in a book aimed at the intermediate level botanist, is to give a flavour of the flora of Upper Teesdale. *Myrrhis odorata* (L.) Scop., *Trifolium medium* L., *Peucedanum ostruthium* (L.) Koch, and *Mimulus* spp. are tenuously included in the 35. By popular visitor demand, eight species of orchids are described, with an informed reference to conservation, and the 50 are made up with seven late-flowering meadow species "not originally destined for inclusion". Eight routes or sites, chosen to see these plants, are carefully explained and clearly benefit from local knowledge. These are accompanied by a map and a chart. The arrangement is phenological, apart from the orchids. The illustrations with each plant vary in quality: *Gentiana verna* L. and *Minuartia verna* (L.) Hiern are well caught, but that of *Dactylorhiza purpurella* (T. & T. A. Stephenson) Soó is unhelpful. Whether the stem is solid or hollow (with two safe tests given) is usefully emphasised in a key to the orchids. In many of the 50 plants described the differences from similar species are helpfully explained. The form of the footnotes rather creates the impression of afterthoughts, and the statement that "Several other 'Teesdale specialities' are not in fact dealt with in this book" is patently incorrect. Some local names are given; I particularly like 'Prying Annie' for *Succisa pratensis* Moench.

Given that several references are made to the various geographical elements represented in the flora of Upper Teesdale, and to ". . . the relict late-Glacial arctic/alpine flora", a short section explaining why the flora is thus unique would have been helpful.

One reference is made to a discovery, namely: "John Binks discovered [*Equisetum pratense* Ehrh.] in early Victorian times"! Binks died in 1817 (*The botanical exploration of Upper Teesdale*, F. Horsman in prep.). A party including James Backhouse Snr. and Jnr. discovered it in Upper Teesdale in 1844 (*Phytol.* **1**: 1065–69, 1844).

Given the constraints placed upon this book, dealing with such a sensitive area, it is a good compromise. However, for those few members who have not yet made their pilgrimage to this mecca, I suspect they will find the book rather disappointing.

F. HORSMAN

Plants of Dhofar. A. G. Miller & M. Morris; illustrated by S. Stuart-Smith. Pp. xxvii+361, with numerous colour illustrations. Published by the Government of Oman, Muscat. 1988. Price £30 (ISBN 0–7157–0808–2).

This beautiful and scholarly book highlights the remarkable flora of Dhofar, a little known botanical and cultural enclave on the southern coast of the Arabian Peninsula. I accompanied Tony Miller (of the Royal Botanic Garden at Edinburgh) on his first plant collecting trip to this Southern Region of Oman in September 1979. Despite being familiar with the plants of northern Oman, most of the species and many of the genera here were unknown to me and this book will become a valued and interesting reference work for other ecologists, botanists and travellers who are similarly greeted by the grand vistas of the moist jebels of Dhofar.

About 190 of the approximately 750 species of higher plant found in Dhofar are illustrated, all in

colour. The illustrations are excellent in terms of their lay-out, artistry and their attention to botanical detail; dissections of flowers and fruit and details of the bark and thorns and succulent stems are included where appropriate. Most of the plants were painted from living specimens and many have never been illustrated before; Susanna Stuart-Smith deservedly won a gold medal when some of these paintings were exhibited at the Royal Horticultural Society.

Facing each plate a single paragraph of 7–10 lines gives a clear and detailed botanical description (in English) of the species concerned. This is followed by text describing the distribution and habitat of the species (and genus) in Dhofar and elsewhere, along with other information on the plant's biology, the origins of the Latin name, etc. This makes interesting reading and presents a challenge to the plant geographer as there are two genera and 50 species endemic to Dhofar and a number of taxa with markedly discontinuous distributions; the most remarkable of these is *Thamnosma* (Rutaceae) which has one species in Somalia and South Arabia, another species on Socotra (with which the flora of Dhofar has close affinities), two in the deserts of S. W. Africa and a further two in California and Mexico.

This botanical section leads into the description and discussion of the ethnobotany of the plants. Just as the botanical and artistic parts of this book are a tribute to the efforts of their creators, the clear way in which the wealth of information on the varied uses of these plants has been presented is a credit to Miranda Morris, who has conducted painstaking research into the non-Arabic languages and ethnography of the people of Dhofar for more than 10 years. To a botanist, and I hope a wider audience, these sections are eminently readable and not just a list, thanks to Dr. Morris's style and intimate knowledge of the area and its people. One should not be deterred by the use of specialist terms as there is an informative glossary which will add some words to your vocabulary – did you know that "sternutatory" refers to an agent that causes sneezing? The Jibbalis (the hill people of Dhofar) evidently know their plants and how to benefit from them in diverse ways, and to have a botanist and linguist (plus artist) working together ensures that the information on medicinal use is accurate and relates to a particular, named species. In years to come, the information may not be available from its original source as the old lifestyle of the Jibbalis and their traditional dependence on plants disappears with the rapid development that has taken place in Oman since 1970.

I have noticed a few very minor discrepancies in the book, e.g. on p. 6 *Blepharis linariaefolia* is said to be the only species of *Blepharis* in Oman, other than *B. dhofarensis*, yet on p. 8 a third species *B. ciliaris* is said to occur in northern Oman; there is no reference in the text to the lovely illustration of *Eulophia guineensis* as the frontispiece; the introductory paragraph on the genus *Acacia* is presented on p. 180 *following* descriptions of two other *Acacia* species on the previous pages. Information on the local distribution of a particular plant in the botanical part of the text is occasionally repeated in the ethnobotanical part (for instance *Ipomoea pes-caprae*) – and it is the only book I can recall that has two separate introductions! But these quirks do not detract from the positive aspects of the book.

It is not a field guide (it weighs 2 kg!) and does not pretend to be one, but I think a good selection of plants has been chosen including nearly all of the dominant woody species, most of the endemics and those of especial scientific interest – thus species such as the frankincense (*Boswellia sacra*), the wild myrrhs (*Commiphora* spp.), the aloes (*Aloe* spp.) and other succulents and tubers (particularly in the Asclepiadaceae) are covered. The families are presented in alphabetical order which I find satisfactory, but I would have preferred the Dicotyledones and Monocotyledones to have been treated separately. Grasses are not included. Brief sections discuss the climate (the monsoon rain and the dense mist and cloud that make Dhofar so unusual), the vegetation zones, phytogeography, local plant names, traditional medicine, etc., and there are checklists of Latin and local names.

Now that Oman is cautiously opening its doors to visitors, I can recommend Dhofar to those considering an adventurous holiday in an unusual and beautiful part of the World, and I certainly recommend this book as one of their companions and to take home and treasure.

R. WHITCOMBE

Flora of New Zealand, Volume IV. *Naturalised Pteridophytes, Gymnosperms, Dicotyledons*. C. J. Webb, W. R. Sykes & P. J. Garnock-Jones. Pp. lxviii+1365, with 16 colour plates and 123 figures in the text. D.S.I.R., Christchurch, New Zealand. 1988. Price N.Z.$88 (ISBN 0–477–02529–3).

The study of the arrival, establishment and subsequent spread of introduced plant species has long been a subject of some interest to botanists throughout the world. Many papers and a number of books have been published on the topic, but apart from S. T. Dunn's fragmentary *Alien Flora of Britain* (1905) a regional flora largely devoted to naturalized adventives is virtually a novelty.

The New Zealand flora comprises over 2900 taxa, of which approximately half are established introductions originating from other parts of the globe. The latest volume of the Flora treats these except for the monocotyledons which will be dealt with in a later part. Keys and detailed descriptions of families, genera and species are provided and data are given on their introduction, dispersal mechanisms, habitat preferences and ecology. Keys are also provided to families containing aquatic and parasitic species. For genera possessing both indigenous and introduced species the former are also keyed out and described.

Among the genera with the largest number of naturalized species are *Trifolium*, *Rubus*, *Eucalyptus*, *Solanum*, *Salix*, *Senecio* and *Veronica*. Hundreds of taxa presumed native in the British Isles are found as adventives in New Zealand, including such rarities as *Crepis foetida*, *Erica vagans*, *Galium debile* and *Veronica verna*. Many other introductions are also adventives familiar to British botanists, e.g. *Galinsoga parviflora*, *Calystegia silvatica*, *Epilobium ciliatum*, *Rubus procerus*, *Heracleum mantegazzianum*, *Buddleja davidii* and *Veronica filiformis*, the last mentioned a comparatively recent invader of lawns and grass verges. Notable absentees in the islands are *Aethusa cynapium*, *Chenopodium rubrum* and *Lepidium ruderale*. *Betula pendula* is naturalized but *B. pubescens*, though in cultivation, does not appear to have escaped to the wild. *Conyza canadensis* is part of a complex, the true species being rare, and the most widespread being the S. American *C. bilbaoana* E. J. Remy, which differs in its inconspicuous ligules, and narrow-triangular, inner involucral bracts; *C. parva* Cronq. from N. America, generally a smaller, more slender plant than *C. canadensis* with glabrous, linear bracts is also present. Do we perhaps need to reexamine our British populations of *C. canadensis*?

An interesting factor is that, as in Europe, there has been a great decline in cornfield weeds. This began earlier for *Agrostemma githago* and *Scandix pecten-veneris*; both were widespread at the turn of the century but have not been reported from New Zealand since 1930. Agricultural pests are all too frequent and include an unlikely trio in *Ulex europaeus*, *Berberis darwinii* and *Erica lusitanica*.

The taxonomy and nomenclature used are up-to-date and of a very high standard, but *Amsinckia calycina* (Moris) Chater is probably referable to *A. micrantha* Suksd., *Anchusa barrelieri* (All.) Vitman is now usually assigned to *Cynoglottis barrelieri* (All.) Vural & Kit Tan, while *Galeobdolon luteum* cv. *Variegatum* is probably synonymous with *G. argentatum* Smejkal, recently reduced to *Lamiastrum galeobdolon* subsp. *argentatum* (Smejkal) Stace in Britain. *Conyza albida* Willd. ex Sprengel is a synonym of *C. sumatrensis* (Retz.) E. Walker, naturalized for some years in the Channel Islands, and now spreading in S.E. England, while the earliest name for *Silene maritima* as a subspecies of *S. vulgaris* appears to be *S. vulgaris* subsp. *alpina* (Lam.) Nyman and not *S. vulgaris* subsp. *maritima* (With.) Á. & D. Löve. These, however, are minor points in an identification manual of great excellence which should prove an invaluable addition to the bookshelves of all plant taxonomists.

D. H. Kent

Report

ANNUAL GENERAL MEETING, 12 MAY 1990

The Annual General Meeting of the Society was held in the Bourne Laboratories Lecture Theatre, Royal Holloway and Bedford New College, Egham Hill, Egham, Surrey, by kind invitation of Professor W. C. Chaloner. Professor J. D. Dodge welcomed the Society to the College and 105 members were present to hear the Presidential Address, by Professor D. A. Webb, *Genera, hollow curves and boojums* (see page 247). This was followed by the Annual General Meeting at 11.45.

Apologies for absence were read, including those of Professor Chaloner who was in France for his election as a Foreign Member of the French Academy of Sciences, on which this Society offered congratulations. Minutes of the 1989 Annual General Meeting as published in *Watsonia* **18**: 115–117 (1990), were approved and signed by the President, Professor D. A. Webb, Sc.D., F.M.L.S., who was in the Chair.

REPORT OF COUNCIL

The report had been circulated to members and there were no queries from the floor. The Hon. Treasurer commented that since the Report had been written, changes in staff and work priorities in the Department of Botany at The Natural History Museum might affect the joint project for a computerised database for nomenclature and bibliography of the flora of Britain and Ireland, as approved by Council. The funding for this project from the Welch Bequest would therefore be delayed until the arrangements with the Museum had been clarified. The adoption of the Report was then proposed by Dr T. C. G. Rich, seconded by Mr. A. O. Chater, and unanimously approved.

TREASURER'S REPORT AND ACCOUNTS

The Hon. Treasurer, proposing the adoption of his Report and Accounts, offered to explain any points, but there were no queries. The adoption was seconded by Mr D. J. McCosh and passed unanimously.

RE-ELECTION OF HON. GENERAL SECRETARY AND HON. TREASURER

The re-election of these officers was proposed by Dr T. C. G. Rich, seconded by Dr F. H. Perring and unanimously approved with applause.

ELECTION OF COUNCIL MEMBERS

In accordance with Rule 10, nominations had been received for Miss L. Farrell, Mr D. A. Pearman and Mr C. D. Preston. Their election was proposed by Dr R. J. Pankhurst, seconded by Mr J. Bevan, and passed unanimously.

RE-ELECTION OF HONORARY AUDITORS

The Hon. Treasurer in proposing the re-election of Grant Thornton, West Walk, Leicester emphasised that it was an honour for the Society to present their Accounts over the name of these

distinguished Auditors. Their election was passed unanimously, and the President agreed to write expressing thanks from the Society.

ANY OTHER BUSINESS

Mr R. G. Ellis proposed with appreciation and affection a vote of thanks to the re-elected officers. This was seconded by Mrs A. Lee and carried with applause.

Mr B. Gale and his assistants were thanked for their local organisation, and the meeting ended at 12.53.

M. Briggs

FIELD EXCURSIONS HELD IN CONJUNCTION WITH THE A.G.M.

LONDON UNIVERSITY BOTANIC GARDENS, SURREY. 12 MAY 1990

After the A.G.M., members visited the University's Botanic Gardens – where guided tours were led by Dr B. W. Ferry, Mr B. A. Gale, Dr A. J. Hemsley and Dr M. Ingrouille.

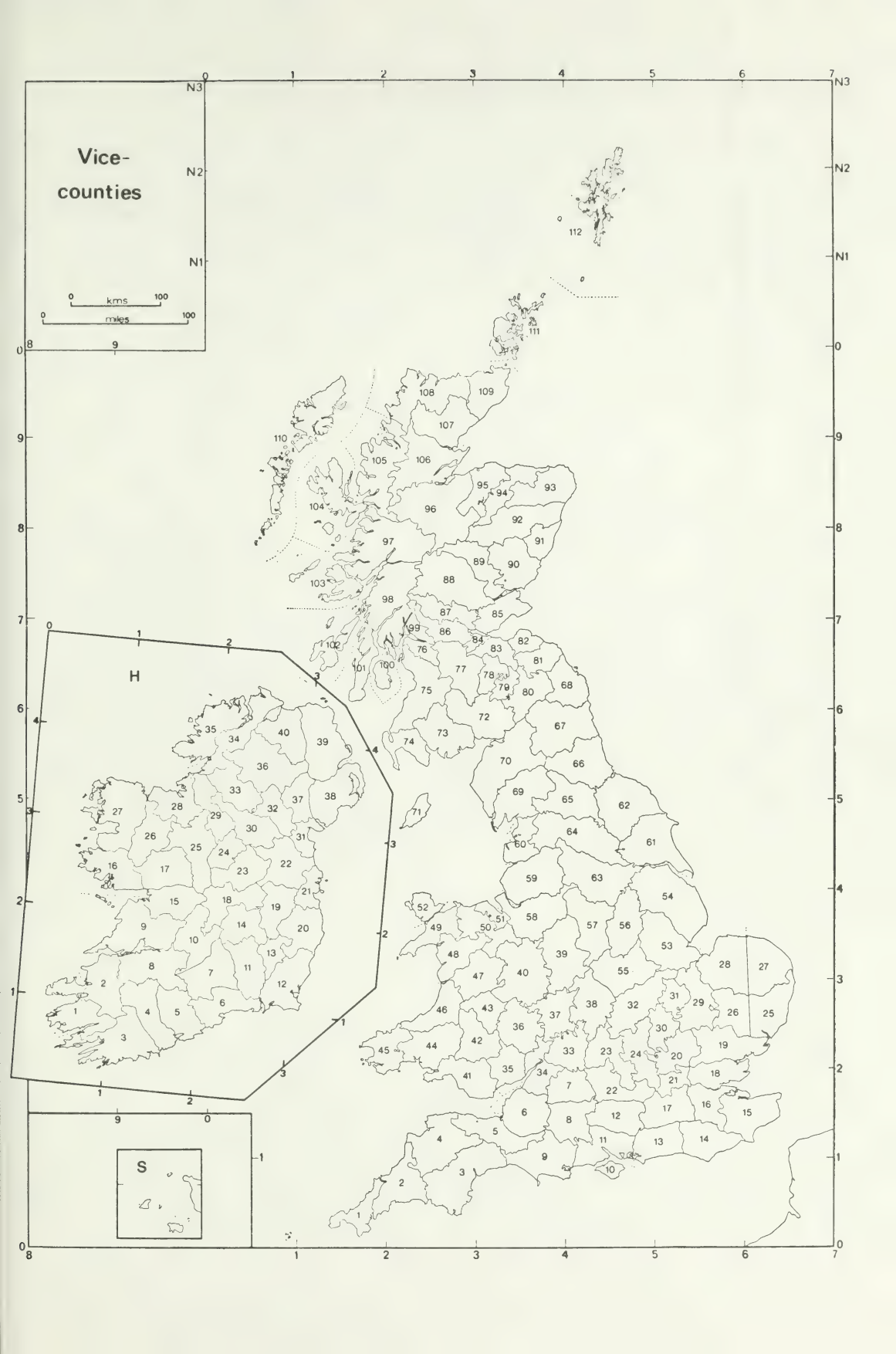
LANGHAM PONDS, SURREY. 12 MAY 1990

30 members enjoyed an evening visit to this famous S.S.S.I. – led by Mr R. Davidge and Mr J. M. Mullin.

SILWOOD PARK, BERKSHIRE. 13 MAY 1990

About 40 members spent a splendid day at the country estate of the Imperial College of Science, Technology & Medicine (University of London). Dr V. K. Brown, Dr M. J. Crawley and Dr A. Gange explained the research work on plant-invertebrate interrelationships that is being undertaken there and led tours of the extensive grounds.

B. A. Gale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NAMES OF VICE-COUNTIES IN *WATSONIA*

ENGLAND, WALES AND SCOTLAND

1. W. Cornwall
1b. Scilly
2. E. Cornwall
3. S. Devon
4. N. Devon
5. S. Somerset
6. N. Somerset
7. N. Wilts.
8. S. Wilts.
9. Dorset
10. Wight
11. S. Hants.
12. N. Hants.
13. W. Sussex
14. E. Sussex
15. E. Kent
16. W. Kent
17. Surrey
18. S. Essex
19. N. Essex
20. Herts.
21. Middlesex
22. Berks.
23. Oxon
24. Bucks.
25. E. Suffolk
26. W. Suffolk
27. E. Norfolk
28. W. Norfolk
29. Cambs.
30. Beds.
31. Hunts.
32. Northants.
33. E. Gloucs.
34. W. Gloucs.
35. Mons.
36. Herefs.
37. Worcs.
38. Warks.
39. Staffs.
40. Salop
41. Glam.
42. Brecs.
43. Rads.
44. Carms.
45. Pembs.
46. Cards.
47. Monts.
48. Merioneth
49. Caerns.
50. Denbs.
51. Flints.
52. Anglesey
53. S. Lincs.
54. N. Lincs.
55. Leics.
55b. Rutland
56. Notts.
57. Derbys.
58. Cheshire
59. S. Lancs.
60. W. Lancs.
61. S.E. Yorks.
62. N.E. Yorks.
63. S.W. Yorks.
64. Mid-W. Yorks.
65. N.W. Yorks.
66. Co. Durham
67. S. Northumb.
68. Cheviot
69. Westmorland
69b. Furness
70. Cumberland
71. Man
72. Dumfriess.
73. Kirkcudbrights.
74. Wigtowns.
75. Ayrs.
76. Renfrews.
77. Lanarks.
78. Peebless.
79. Selkirks.
80. Roxburghs.
81. Berwicks.
82. E. Lothian
83. Midlothian
84. W. Lothian
85. Fife
86. Stirlings.
87. W. Perth
88. Mid Perth
89. E. Perth
90. Angus
91. Kincardines.
92. S. Aberdeen
93. N. Aberdeen
94. Banffs.
95. Moray
96. Easterness
96b. Nairns.
97. Westerness
98. Main Argyll
99. Dunbarton
100. Clyde Is.
101. Kintyre
102. S. Ebudes
103. Mid Ebudes
104. N. Ebudes
105. W. Ross
106. E. Ross
107. E. Sutherland
108. W. Sutherland
109. Caithness
110. Outer Hebrides
111. Orkney
112. Shetland

IRELAND

H1. S. Kerry
H2. N. Kerry
H3. W. Cork
H4. Mid Cork
H5. E. Cork
H6. Co. Waterford
H7. S. Tipperary
H8. Co. Limerick
H9. Co. Clare
H10. N. Tipperary
H11. Co. Kilkenny
H12. Co. Wexford
H13. Co. Carlow
H14. Laois
H15. S.E. Galway
H16. W. Galway
H17. N.E. Galway
H18. Offaly
H19. Co. Kildare
H20. Co. Wicklow
H21. Co. Dublin
H22. Meath
H23. Westmeath
H24. Co. Longford
H25. Co. Roscommon
H26. E. Mayo
H27. W. Mayo
H28. Co. Sligo
H29. Co. Leitrim
H30. Co. Cavan
H31. Co. Louth
H32. Co. Monaghan
H33. Fermanagh
H34. E. Donegal
H35. W. Donegal
H36. Tyrone
H37. Co. Armagh
H38. Co. Down
H39. Co. Antrim
H40. Co. Londonderry

WATSONIA

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Botanical Society of the British Isles

Patron: Her Majesty Queen Elizabeth the Queen Mother

Applications for membership should be addressed to the Hon. General Secretary, c/o Department of Botany, The Natural History Museum, Cromwell Road, London, SW7 5BD, from whom copies of the Society's Prospectus may be obtained.

Officers for 1991-92

Elected at the Annual General Meeting, 4th May 1991

President, Dr P. Macpherson

Vice-Presidents, Mr J. Ounsted, Mr P. S. Green, Dr G. Halliday, Mr A. C. Jermy

Honorary General Secretary, Mrs M. Briggs

Honorary Treasurer, Mr M. Walpole

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Papers and Short Notes, J. R. Edmondson, R. J. Gornall, E. C. Nelson, B. S. Rushton*

Plant Records, C. D. Preston

Book Reviews, J. R. Edmondson

Obituaries, J. R. Akeroyd

*Receiving editor, to whom all MSS should be sent (see inside back cover).

FEB 2 3 1996 GRAY HERBARIUM

Watsonia, **18**, 333–342 (1991)

The pollination of *Arum maculatum* L. – a historical review and new observations

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ABSTRACT

Previous accounts of the complex trap pollination mechanism in *Arum maculatum* L. (Araceae) are briefly reviewed; they conflict in some details and are incomplete. Our own study showed that the species is self-incompatible; it traps female owl-midges *Psychoda phalaenoides* as the main pollinator, and papillae on the spathe and column surfaces stop them escaping. A fluid, consisting of a dilute sugar solution, surrounds the stigmas in most plants. This is not taken by the flies but acts as a site for pollen deposition and germination.

One pollen-bearing fly can carry over 150 pollen grains and can effect full pollination of the female flowers but, in our study sites, the numbers of flies were limited and some inflorescences failed to set fruit owing to lack of pollination. Experimental removal of parts of the inflorescence led to a reduction in the numbers of flies caught and in the number of inflorescences setting fruit, contrasting with previous work. It is concluded that all parts of the trap mechanism are essential to ensure full fruit set. In addition, the more flies that are caught, the more likely a plant is to act as a pollen donor to other plants.

INTRODUCTION

Lords-and-Ladies, *Arum maculatum* L., is one of Britain's most distinctive native plants. It grows in woodlands and shady hedgerows where the first signs of its presence are the broad glossy emerald leaves as they emerge through the sparse February ground flora. In late April or early May a pointed shoot growing from the centre of the leaf rosette unfurls to become the bizarre inflorescence for which the plant is famed. The species belongs to the huge, mainly tropical family, Araceae and is the only common British member of the genus. The centre of radiation of the genus *Arum* is in the Eastern Mediterranean (Prime 1960, 1980) and Britain and Ireland form the northern and western limit of its range. Bown (1988) gives a general, and beautifully illustrated, account of the whole family.

Arum maculatum spreads vegetatively to form clonal colonies, but these are restricted to a small local patch, up to about 1 m in diameter (Prime 1960). Reproduction and dispersal in the species is mainly by seed. The inflorescence of *A. maculatum* consists of a group of 20–40 female flowers at the base, then a whorl of hairs derived from sterile flowers, followed by 60–100 male flowers, another set of hairs and the whole is topped by a spadix (Fig. 1). A spathe surrounds this and remains fully furled around all the flowers up to the base of the spadix, acting as a trap for insects. This most unusual inflorescence, along with other peculiar features of the plant, has attracted considerable interest which culminated in the publication of the classic monograph, *Lords-and-Ladies*, by Prime (1960, reprinted 1981). Prime readily acknowledged that much remains to be discovered, but since 1960 very little work appears to have been done.

FUNCTION OF THE INFLORESCENCE PARTS IN POLLINATION

PREVIOUS ACCOUNTS

In past accounts there was some confusion over the working of the trap mechanism and the importance of the various parts of the inflorescence in pollination. Prime (1960) described in detail the events surrounding pollination, his account consisting of an amalgamation of past work and

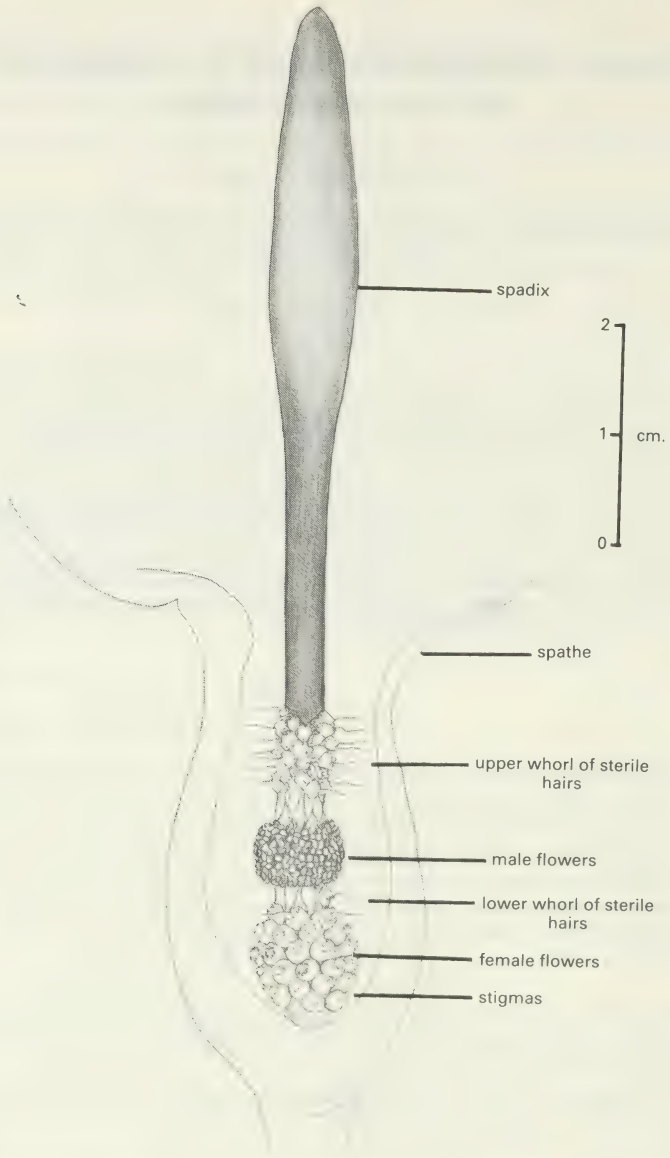

FIGURE 1. Inflorescence of *Arum maculatum* with spathe chamber cut open.

some of his own observations. The following is a summary of his account: as the spathe unfurls the female flowers are receptive and the spadix produces a "foul and urinous" smell from compounds volatilised by respiratory activity in the spadix. The smell attracts flies which breed in dung and, in particular, females of a single species of owl midge, *Psychoda phalaenoides* L. It is not clear where these flies alight, from Prime's account, but, by implication, they alight at the base of the spadix. The flies crawl downwards into the spathe chamber and, once inside, the upper whorl of trap hairs makes it impossible for them to fly out (though he suggests that they could crawl out up the spathe since the hairs do not reach the chamber wall). Through walking around the chamber, they may deposit any pollen they are carrying on to the receptive stigmas. Usually by the following morning

the smell of the spadix is gone, the stigmas are withered and a small drop of "nectar" (see later) is secreted by the female flowers, which the flies take. Pollen is shed by the male flowers, some of which is picked up by the flies, and the trap hairs begin to wither. Prime suggested that the flies then escape by crawling up the spathe wall.

Unknown to Prime until after he had written his account, Knoll (1926) had studied *Arum nigrum* in detail in Dalmatia, and this was brought to the attention of British botanists by Dormer (1960). Differences from Prime's account include the fact that the insects land on the spathe (though this is not entirely clear) and fall into the chamber (not crawl) as a result of its slippery surface. This surface has downward pointing papillae covered with oil droplets, to half way down the spathe chamber. The insects cannot climb the spathe or up the central column, owing to similar papillae on the column just above the female flowers. The upper whorl of hairs is therefore not relevant in preventing escape of the trapped flies, but stops larger insects, which may damage the inflorescence, from entering. "Nectar" is secreted throughout the female phase as well as the male phase and shedding of the pollen is accompanied by a crumpling of the epidermal cells of the column, allowing the insects to crawl up the spadix, rather than the spathe, to escape.

Although Knoll's work applied specifically to *Arum nigrum* and not *A. maculatum*, Meeuse (1961), Proctor & Yeo (1973) and Faegri & van der Pijl (1979) all quoted his account with the proviso that some of the details may not apply to *A. maculatum*, and ignored Prime's. Popular accounts in newspapers, newsletters and floras have variously combined these accounts and invented new variations of their own! *A. nigrum* is larger than *A. maculatum* and the lower whorl of trap hairs is similar to the upper whorl, whereas in *A. maculatum* the lower whorl has fewer hairs (often only two or three, Fig. 1) (Knoll 1926; Proctor & Yeo 1973 and personal observations). *A. nigrum* appears to attract many dung-feeding flies (all those small enough were found in the chamber (Knoll 1926)) whereas *A. maculatum* specifically attracts female *Psychoda phalaenoides* and, in places, *P. grisescens* Tonnoir (Proctor & Yeo 1973).

OBSERVATIONS FROM THE PRESENT STUDY

This investigation was set up to clarify the working of the trap mechanism. It was done mainly in a mature hedgerow on the edge of a playing field in Oxford (v.c. 23), where *Arum maculatum* was abundant (site A). Three further sites, one in an exposed hedgerow by fields (site B), another in a damp hollow near some young beeches (site C) and a third by paths in scrub woodland (site D), were used for comparison. Sites B, C and D were in the Chiltern region near Reading (v.c. 22). A fifth site, in a wooded garden in Cumbria (v.c. 69) was used in 1990 (site E).

The self-incompatibility system was tested using nine inflorescences in site A in 1990. These were covered in semi-opaque paper bags, before opening, on 5 May 1990, and were examined each day after that. When open, two were cross-pollinated artificially using a small paint-brush with pollen from two inflorescences from other plants several metres away, on 10 May. The pollen was dusted on to as many of the female flowers as possible through a hole cut in the spathe chamber wall. Damage to the chamber was minimised and it was difficult to reach the flowers on the opposite side of the column to the hole. Two other inflorescences were artificially self-pollinated in the same way on 14 and 15 May, but using pollen from the same inflorescence. The other five were left unpollinated. Checks on the inflorescences were made regularly thereafter until a final recording of fruit and seed set on 21 June 1990. 15 further inflorescences were bagged and left undisturbed in site E between 1 and 7 May 1990 and checked regularly until 22 July 1990.

Observations of the trap mechanism and the visiting insects were made using porous plastic windows inserted into the chamber wall of 30 inflorescences of *Arum maculatum* in late April and early May 1988 in site A and 35 inflorescences in early May 1990 in site E. Approximately 120 individuals of *Psychoda phalaenoides* were seen through these, over a period of several days in varying weather conditions.

To examine the surface of the spathe and column a series of transverse sections were taken through the spathe chamber wall and the column and examined under a light microscope.

The fluid around the stigmas (the "nectar" of Prime and others) was extracted from approximately 150 flowers on 13 inflorescences using microcapillaries. Measurements of the concentration of sugar, measured as a standard sucrose equivalent, were made on extracts from 5–10 flowers combined using Bellingham and Stanley pocket refractometers adjusted to read small volumes (Corbet 1978; Lack 1982). Extracts from five further inflorescences, one of which had reached the

male phase and the fluid had many pollen grains in it, were analysed for their amino acid content using the method of Yarwood (1989) which can detect trace quantities.

Pollen germination was tested by placing fresh pollen on 1) fresh stigmas, 2) in the stigmatic fluid, 3) in fluid from cut stems and 4) in tap water. Germination was recorded after twelve hours.

RESULTS

The two inflorescences which were artificially cross-pollinated set 20 out of 35 fruits (57%) and 27 out of 39 fruits (69%). These fruits had 1–5 seeds (most 2 or 3) with a mean of 1·8 seeds and 2·6 seeds respectively (excluding fruits that did not set). It was clearly noticeable that most of the fruits which failed to set on the crossed plants were those behind the column from the hole through which pollinations were made. The artificially selfed inflorescences produced 0 out of 34 fruits (0%) and 6 out of 30 fruits (20%) (mean seed number 2·5). None of the bagged and undisturbed inflorescences set any fruit. In many of the selfed and undisturbed inflorescences the fruit started to swell and only stopped about two weeks after inflorescence opening, when they withered. These results show that, normally, *A. maculatum* is strongly self-incompatible (confirming Prime (1960)). The few fruits set on one selfed inflorescence must have arisen either from a weak self-compatibility in the one plant or from contamination of the self pollen load on the paint brush with a few grains from another plant.

Most spathes opened in mid- to late morning, but there was some variation in the timing of flowering events and some opened at almost all times of the day. The smell was normally apparent immediately. Most of the *Psychoda phalaenoides* entered the chambers around dusk or in the early part of the night (before midnight) during the warm dry weather in which observations were made. When the weather is wetter or cooler they may be more active in daylight hours. They almost invariably landed on the spathe and fell into the trap, usually after slipping several times; only two, out of 55 seen entering, crawled in. Once inside, the flies can and did climb the central column, past the lower whorl of hairs and the male flowers to the upper whorl of hairs. These hairs are very close together and appeared to have a slippery surface, and this prevented the flies from manoeuvring between them and escaping. On the second day no smell was apparent and copious pollen was shed from the anthers which fell into the spathe chamber and on to any insects inside, and the hairs withered. The spathe remained impossible for the flies to climb, but they climbed the spadix past withered hairs to escape.

The sections through the spathe showed that papillae cover the open spathe and spadix and extend down on the spathe to half way up the female flowers (as described by Knoll (1926) for *A. nigrum*), with a transition zone, of approximately 5 mm, of progressively smaller papillae. The papillae pointed at 90° to the wall of the spathe and spadix. Papillae on the spadix extended down to the top of the upper whorl of hairs.

The stigmatic fluid was detected in only about two-thirds of inflorescences and varied in quantity up to about 0·3 μl per flower. It was not apparent when the spathe first unfurled, but appeared after about three hours and before most of the *Psychoda* were caught. It surrounds the feathery stigma, when present, and appears to be resorbed soon after the trap hairs wither. The concentration of sucrose equivalent was between 9% and 12·5% in all samples. The amino acids leucine, isoleucine and/or methionine were detected in the fluid which had pollen in it, but the other four fluid samples had no detectable amino acids. The sugar is only slightly more concentrated than that in the fluid which exuded from cut stems, mainly arising from the phloem – 8% sucrose equivalent was recorded from each of three cut stems.

Despite several periods of observing *Psychoda* inside the spathe chamber we never observed them taking the stigmatic fluid (contrary to Prime's (1960) claim) and many inflorescences had fluid and *Psychoda* present. *Psychoda* species are not known to feed during their adult lives (P. Withers, pers. comm. 1990). We must conclude either that the fluid has no function in *A. maculatum*, or that its function is nothing to do with a food reward for the insect visitors. It was often noticeable that, in an inflorescence's male phase, much pollen was trapped in the fluid and many grains had germinated. Observations on the germination of pollen grains showed that they germinate readily in the stigmatic fluid, including that from the same inflorescence, and on the stigmas and in tap water, although not in the fluid from cut stems.

Baker *et al.* (1973) analysed the contents of stigmatic exudates of 39 species of various plant families (in California and Costa Rica) and summarised previous accounts. They found amino acids

in exudates from 38 of the 39 species as well as lipids and other substances. They interpreted the function of the exudates as, in some plants, nutritional for the pollinating insects and, in others, as direct aids in the pollination process i.e. as sites for pollen germination and as a sticky fluid to make pollen adhere to the insects. They, and Eisikowitch *et al.* (1990), studying the highly specialised *Asclepias syriaca*, found that pollen germinated in exudate of up to 20% sucrose but not in higher concentrations. Eisikowitch *et al.* (1990) showed that the tubes burst in concentrations of 5% or less. The concentrations required for pollen germination, therefore, are much lower than those found in normal nectar, which acts as a food reward (Corbet 1978).

It seems that the stigmatic fluid in *A. maculatum* is not nectar in any recognised sense, but that its function is as a trap for pollen grains, as a *Psychoda* crawls over the inflorescence, and as a site for pollen germination. It may also help pollen to adhere to a *Psychoda* if some is brushed on to it in the spathe chamber.

Fluid is present around the stigmas of other members of the Araceae (a large quantity in some), and, in some, appears to act as a food source for visiting pollinators, though very little study has been done (Bown 1988). In *Arum hygrophilum* in Israel, Koach (1985) reported that *Psychoda cinerea* Banks males are trapped and may live longer inside *Arum* because of high humidity maintained by the stigmatic fluid (5% sucrose) and possibly from nutrition.

THE IMPORTANCE OF THE TRAP MECHANISM IN POLLINATION

Despite the elaborate trap structure and apparent effectiveness of the mechanism in *Arum maculatum*, the importance of it for pollination in the species was brought seriously into question by Schmucker (1925), whose experiments were reported by Prime (1960). Schmucker (1925) removed the spadix and/or the spathe from plants of *A. maculatum*, but found no effect on fruit or seed set from any of these mutilations (Table 1). The only detrimental effect on fruit set that he found was from removal of the upper whorl of hairs in addition to the spathe and spadix, and this he attributed to a wound response. Meeuse (1978) studied several members of the Araceae and found that damage to the male flowers had an inhibitory effect on flowering (perhaps hormonal). He did not refer to Schmucker (1925), but his observations back up the possibility of a wound influencing fruit set. Although Schmucker's (1925) conclusions were most unexpected, no further work on this appears to have been done. The implication from Schmucker's work was that the trap mechanism was a vestige from the species' evolutionary past, important perhaps in other members of the genus, but not in *A. maculatum*.

This investigation was set up to see whether we could duplicate and elaborate on Schmucker's experiments. Three aspects of the trap mechanism were studied:

1. whether various treatments to the trap mechanism had an effect on numbers of insects caught;
2. what effect the treatments and the numbers of insects caught had on seed and fruit set of the inflorescences; and
3. how many pollen grains an individual *Psychoda* may carry.

TABLE 1. NUMBER OF FRUITS AND SEEDS SET BY *ARUM MACULATUM* IN SCHMUCKER'S EXPERIMENTS (from Schmucker 1925)

	Sample size	% setting seed	Mean number of fruits per spike
Open pollinated	47	38	15
Spathe removed	31	32	12
Spadix removed	33	43	14
Spathe and spadix removed	43	26	10
Spathe, spadix and hairs removed	29	17	5

METHODS

Inflorescences of *Arum maculatum* were treated in the following ways:

1. Spathe removed
2. Spadix removed
3. Spathe and spadix removed
4. Hole cut in the spathe chamber wall
5. Open-pollinated (control)

It was found that earwigs sometimes entered the chamber through the hole cut for treatment 4; all inflorescences in this treatment were checked two days after flowering for any damage, and damaged inflorescences were not used. All treatments were made before 07.00 hours and before the spathe unfurled. Treated inflorescences were at least 1·5 m apart, and were labelled with plastic tags. Sample sizes varied mainly owing to problems of diseased, damaged or otherwise unusable inflorescences and are given in the results.

Treatments 1, 2 and 5 were carried out on inflorescences in site A which opened before 11.00 hours on 13 May 1988. The insects from each inflorescence were collected after 22.30 hours the same day, by placing a cotton wool plug soaked in ethyl acetate over the entrance to the chamber before extracting the insects. This ensured that the majority of the insects that the spike would catch had been caught.

Further flower spikes were chosen at random between 24 April and 8 May 1988 and subjected to one of the five treatments. They were then left to mature undisturbed over the next nine weeks. Their condition was checked regularly and any inflorescence that was damaged or diseased was discarded from the sample groups. The maturing fruits were collected during June and July as they began to turn yellow and mature, but before any frugivores (mainly blackbirds, Snow & Snow 1988) ate them. The number of seeds, fruits and aborted fruits (unswollen ovaries) were recorded.

A direct measure of the effect of number of insects caught on fruiting success was made between 25 April and 12 May 1989. Insects were collected from open pollinated inflorescences towards the end of the female phase, on the second morning of spathe opening between 07.00 and 08.30 hours. Each study inflorescence was checked to see that the anthers had not dehisced and no insect had escaped. Inflorescences were chosen to show a range of numbers of insects caught. The insects were collected by placing a glass sample tube over a hole cut in the spathe chamber wall. No ethyl acetate was used in case of an effect on fruit maturation. The insects were then counted and the inflorescence left to develop. Checks were made after two days that intruders had not entered through the hole and damaged the inflorescence and further checks were made regularly for any damage. Numbers of fruits and seeds set were measured as described above. In 1990, to investigate whether numbers of insect visitors limited fruit set, 28 spikes in site E, which were left open to insects, were artificially cross-pollinated through holes in the spathe chamber with pollen from three other plants, as described in the self-incompatibility test.

15 individual *Psychoda phalaenoides* were caught as they entered an *Arum* spathe chamber, in site E. The number of pollen grains that they were carrying was counted.

RESULTS

Removal of the spathe or removal of the spadix resulted in fewer insects being caught than in intact inflorescences (Table 2, both comparisons $P<0.001$, Kolmogorov-Smirnov test). There was no difference between these two treatments.

In site A, the percentage of spikes that matured any seed (no fruits were set without seeds)

TABLE 2. NUMBERS OF INTACT INFLORESCENCES OF *ARUM MACULATUM* AND THOSE WITH SPATHE OR SPADIX REMOVED WHICH HAD CAUGHT PARTICULAR NUMBERS OF *PSYCHODA* APPROXIMATELY TWELVE HOURS AFTER OPENING

	Sample size	Numbers of *Psychoda* trapped									
		0	1	2	3	4	5	6	7	8	>8
Intact	25	3	2	1	0	2	2	3	2	1	9
Spathe removed	18	13	3	2							
Spadix removed	24	19	4	1							

TABLE 3. PERCENTAGE OF SPIKES OF *ARUM MACULATUM* THAT SET ANY SEED AND THE MEAN NUMBER OF SEEDS SET IN EACH OF FIVE TREATMENTS

	Site A		Sites B, C, D		All sites
	Sample size	No. setting seed (%)	Sample size	No. setting seed (%)	Mean no. seeds*
Open pollinated	143	57 (40)	111	72 (65)	33·0
Spathe removed	68	12 (18)	48	4 (8)	23·4
Spadix removed	57	10 (18)	38	8 (21)	33·1
Spathe and spadix removed	30	0	23	1 (4)	16
Hole in chamber wall	50	10 (20)	18	8 (44)	13·1

* excluding those which set no seed

differed considerably between the test groups (Table 3). Those that had been manipulated in any way all had a smaller proportion of spikes setting seed than open pollinated inflorescences (all $P<0.01$, ${}^{N}_{N}{}^{2}$ tests). There were no significant differences between any of the treatments except for those from which both spathe and spadix were removed. Only one of these set any seed, significantly less than other treatments (all $P<0.05$, ${}^{N}_{N}{}^{2}$ tests). The percentage of open pollinated inflorescences which set seed was greater in sites B, C and D, pooled, than in site A ($P<0.001$, ${}^{N}_{N}{}^{2}$ test) but differences between manipulated and open pollinated inflorescences were similar to those at site A.

Of those spikes in site A that matured at least one fruit (Table 3), there was no significant difference in the number of seeds set by spikes with either the spathe or spadix removed compared with the open pollinated group. It seems that, if it is fertilised at all, all potential fruits are likely to be fertilised. Those spikes with a hole in the chamber wall, however, set fewer seed ($P<0.002$, modified t-tests, not assuming equal population variances). Pooled results from sites B, C and D showed almost exactly the same pattern as site A.

Table 4 shows the results obtained from all four sites together for percentage of potential fruits matured (sample sizes were too small for meaningful comparisons from site A separately). Removal of the spathe and cutting a hole in the chamber wall reduced percentage fruit set ($P<0.01$, Kolmogorov-Smirnov test) but removal of the spadix did not.

Fruiting success did not appear to be related to number of insects caught (Table 5). 82% of the inflorescences that caught any insects set seed and it seems that just one pollen-bearing insect was necessary for full fruit set to occur.

Of the 28 artificially cross-pollinated inflorescences, 27 (96%) set fruit.

The numbers of *A. maculatum* pollen grains recorded on individual *Psychoda* were (in increasing order) 0, 0, 2, 56, 70, 84, 93, 101, 111, 124, 127, 133, >150, >150, >150. The first two of these fifteen and, perhaps, the third (20%) were probably visiting their first *Arum* inflorescence, whereas the others had clearly come from another one.

TABLE 4. NUMBERS OF INFLORESCENCES OF *ARUM MACULATUM* IN VARIOUS TREATMENTS (PERCENTAGES IN BRACKETS) WHICH MATURED PARTICULAR PROPORTIONS OF POTENTIAL FRUITS

Those which matured no fruits excluded from these results.

		Percentage of potential fruits matured					
	Sample size	<20	20–40	40–60	60–80	80–99	100
Open pollinated	129	3 (2)	11 (9)	16 (12)	22 (17)	58 (45)	19 (15)
Spathe removed	16	1 (6)	5 (31)	4 (25)	3 (19)	0	3 (19)
Spadix removed	16	0	1 (6)	2 (12)	4 (24)	8 (47)	1 (6)
Hole in chamber wall	19	8 (42)	4 (21)	3 (16)	0	2 (11)	2 (11)

TABLE 5. NUMBERS OF FRUITS AND SEEDS SET BY PLANTS OF *ARUM MACULATUM* WHICH HAD CAUGHT PARTICULAR NUMBERS OF *PSYCHODA PHALAENOIDES*

Number of *P. phalaenoides* caught	Sample size	No. setting any seed	Mean no. of seeds set*	Mean % fruit set*
0	1	0	—	—
1	6	5	31	65
2	3	1	47	100
3	4	3	34	60
4	5	5	25	66
5	2	1	54	100
6	2	2	19	57
7	0	—	—	—
8	3	2	28	71
>8	8	8	31	72

* excluding those which set no fruits or seeds

DISCUSSION

In all sites, less than 100% of inflorescences set fruit, and in site A in 1988 only 40%. Some inflorescences in all study sites caught no insects and others caught one or very few, and the failure to fruit was related to the availability of *Psychoda phalaenoides*. This was further confirmed by the fact that all but one of the artificially crossed inflorescences set fruit. All the evidence from this investigation leads us to the conclusion that fruit set, in any one year at least, is limited by the numbers of pollinating insects. Fruits set in one year can, however, affect fruit set in the next year (a well-known phenomenon in fruit trees), so a definitive test for what limits fruit set would require following the same plants through two seasons. Possible limitation of fruit set by pollinator availability is recorded in a few species, but only definitively (i.e. as described above) in one, another aroid, *Arisaema triphylla* (Zimmerman 1988). Prime (1960) stated that, from preliminary observations, about 10% of *Arum maculatum* tubers died each year, but that flowering had no apparent effect on the probability of death.

Any disruption to the trap mechanism led to many fewer insects being caught (frequently none) and to lower numbers of inflorescences setting any fruit or seed. In fact, because of the precision of the trap mechanism and the function of all parts of the flower spike and spathe, it was surprising that inflorescences that had parts removed ever caught any insects. On those from which the spathe was removed the spadix was still, clearly, an attractant and one *Psychoda* was observed crawling around the cut edge of the spathe before slipping down and being trapped. On those from which the spadix was removed it is possible that the flies were attracted by the pale colour of the spathe since they appeared to be attracted by light surfaces (personal observation).

Although most spikes which had their spathe, spadix or both removed did not set any seed, of those that set at least one, there was very little difference in numbers of fruit set between the mutilated and intact inflorescences. Only those with the hole cut in the chamber wall set many fewer fruits. It seems that one pollen-bearing *Psychoda* may well be adequate to fertilise all the female flowers successfully so long as it has travelled from another clone; an individual fly can certainly carry enough pollen grains. Since the flies are normally trapped in the chamber for 18–24 hours, and move about during this time, there is plenty of opportunity to deposit the pollen on all the female flowers. In those chambers in which a hole was cut, the flies normally found their way out very quickly and flew off, so it is not surprising to find big reductions in fruit and seed set in these plants, since the flies will not have crawled over all the female flowers. *Psychoda* species live as adults for up to seven days (P. Withers, pers. comm. 1990) and this means that a significant proportion of flies trapped in any one inflorescence (perhaps up to 25%) are likely to be first-time visitors; our results for numbers of pollen grains carried confirm this. Others may come from another inflorescence in the same clone, so the pollen that they are carrying is not viable. These are likely to be the reasons for the lack of any fruit set by some inflorescences which trapped small numbers of insects.

Pollinator availability seems to be the main limiting factor in fruit set in this study, but other

factors may also be important. Some decay of fruiting spikes was noted, particularly in 1988 which was a wet, cool summer, but these were not included in the results. Resource limitation, often important in limiting fruit set (Stephenson 1981), did not appear to play any part in this study, though observations over two years would be needed to confirm this. Predation was not important in our study areas but Snow & Snow (1988) noted that many flower spikes of *A. maculatum* in their Chiltern study sites were eaten by deer before setting any fruit.

The results presented here are in clear contradiction of the results of Schmucker (1925). By chance, it appears that our site A was similar to his site in the overall proportion of open pollinated spikes setting fruit (38% of his spikes set fruit, 40% of ours) and, therefore, is likely to be comparable in pollinator availability and associated factors. This suggests that there are differences in the experimental methods used. Schmucker (1925) was not totally clear about his methods but stated that the treatments were made on spathes that were just about to open. He probably waited until just as the spathes opened to do the tests since this is likely to cause the least damage. We know from our study, however, that this stage may well be too late to prevent pollination. The spadix may smell before the spathe opens and those spathes which had only opened a fraction were sometimes found to have caught insects, though this was only noticeable if the chamber was cut open. We must, therefore, contest Schmucker's conclusion that the trap mechanism is not important for fruiting in *A. maculatum*, since our results show clearly that all parts are important.

It does seem that, for fruit set, it is not important how may insects are caught and that just one *Psychoda phalaenoides*, bearing pollen from another plant, may be adequate for full seed set, but this is only part of the pollination story. The other part, successful dissemination of pollen, is much harder to study and we can only make some suggestions about this in *A. maculatum*. Since pollinating insects are trapped by the *Arum* inflorescences for some hours, it is likely that almost all of the pollen that is taken out of one inflorescence by any one *Psychoda* will be deposited on the next one it visits – pollen carry-over will be minimal. One trapped *Psychoda* will probably mean that a significant number of seeds are fathered on only one other plant, or even none if the next inflorescence it visits is part of the same clone. The more *Psychoda* that are trapped, therefore, the more inflorescences will receive pollen from that individual plant and the more successful that plant will be as a father. This is true in most plants (Bertin 1988) and it suggests that successful trapping of as many *Psychoda* as possible will be important to ensure pollen dispersal.

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REFERENCES

Baker, H. G., Baker, I. & Opler, P. A. (1973). Stigmatic exudates and pollination, in Brantjes, N. B. M. & Linskens, H. F., eds. *Pollination and dispersal*, pp. 47–60. University of Nijmegen, The Netherlands.

Bertin, R. I. (1988). Paternity in plants, in Lovett Doust, J. & Lovett Doust, L., eds. *Plant reproductive ecology*, pp. 30–59. Oxford.

Bown, D. (1988). *Aroids*. London.

Corbet, S. A. (1978). Bee visits and the nectar of *Echium vulgare* L. and *Sinapis alba* L. *Ecol. Ent.* **3**: 25–37.

Dormer, K. J. (1960). The truth about pollination in *Arum*. *New Phytol.* **59**: 298–301.

Eisikowitch, D., Kevan, P. G. & Lachance, M.-A. (1990). The nectar-inhabiting yeasts and their effect on pollen germination in common milkweed, *Asclepias syriaca* L. *Israel J. Bot.* **39**: 217–225.

Faegri, K. & van der Pijl, L. (1979). *The principles of pollination ecology*. Oxford.

Knoll, F. (1926). Die Arum-Blutenstande und ihre Besucher (Insekten und Blumen IV). *Abh. zool.-bot. Ges. Wien* **12**: 379–481.

Koach, J. (1985). *Bio-ecological studies of flowering and pollination in Israeli Araceae*. Unpublished Ph.D. thesis, University of Tel-Aviv (in Hebrew, summary in English).

Lack, A. J. (1982). Competition for pollinators in the ecology of *Centaurea scabiosa* L. and *Centaurea nigra* L. II. Observations on nectar production. *New Phytol.* **91**: 309–320.

Meeuse, B. J. D. (1961). *The story of pollination*. New York.

Meeuse, B. J. D. (1978). The physiology of some sapromyophilous flowers, in Richards, A. J., ed. *The pollination of flowers by insects*, pp. 97–104. London.
Prime, C. T. (1960). *Lords and Ladies*. London.
Prime, C. T. (1980). *Arum* L., in Tutin, T. G. *et al.* eds. *Flora Europaea* **5**: 269–271. Cambridge.
Proctor, M. & Yeo, P. (1973). *The pollination of flowers*. London.
Schmucker, T. (1925). Beitrage zur Biologie und Physiologie von *Arum maculatum*. *Flora* **18**: 460–475.
Snow, B. & Snow, D. (1988). *Birds and berries*. Calton, Staffs.
Stephenson, A. G. (1981). Flower and fruit abortion: proximate causes and ultimate functions. *Ann. Rev. Ecol. Syst.* **12**: 253–279.
Yarwood, A. (1989). Manual methods of protein sequencing, in Findlay, J. B. C. & Geisow, M. J., eds. *Protein sequencing, a practical approach*, pp. 119–145. Oxford.
Zimmerman, M. (1988). Nectar production, flowering phenology, and strategies for pollination, in Lovett Doust, J. & Lovett Doust, L., eds. *Plant reproductive ecology*, pp. 157–178. Oxford.

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The identity of *Euphrasia officinalis* L. and its nomenclatural implications

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ABSTRACT

The treatment of the name *Euphrasia officinalis* L. (Scrophulariaceae) as a nomen ambiguum is rejected. Examination of the lectotype material shows that it matches *E. rostkoviana* Hayne subsp. *fennica* (Kihlman) Karlsson. The name *E. officinalis* takes priority and the following infraspecific taxa are recognised: *E. officinalis* subsp. *officinalis*, *E. officinalis* subsp. *rostkoviana* (Hayne) F. Townsend, *E. officinalis* subsp. **monticola** Silverside **nom. nov.** (= *E. montana* Jordan) and *E. officinalis* subsp. **anglica** (Pugsl.) Silverside **comb. et stat. nov**. The taxonomic treatment of other species in *Euphrasia* series *Euphrasia* is discussed and the implications for the infrageneric arrangement in *Euphrasia* are noted.

INTRODUCTION

The name *Euphrasia officinalis* L. has been generally treated as a nomen ambiguum by those who recognise an aggregate of numerous species, despite the existence of original Linnaean material. There are two sheets of *Euphrasia*, as the genus is now circumscribed, in the Linnaean Herbarium (**LINN**). One represents the distinctive Italian species, *E. tricuspidata* L., the other (sheet 759.2), consisting of three specimens, represents *E. officinalis*. Two of the specimens on the latter sheet have been generally considered to be referable to the taxon currently known as *E. rostkoviana* Hayne, while the third, of Russian origin (see below), has been regarded as *E. nemorosa* (Pers.) Wallr. (including *E. curta* (Fries) Wettst.) (Townsend 1867; Pugsley 1930), or as *E. stricta* J. P. Wolff ex J. F. Lehm. (Yeo 1972). Sell & Yeo (1970) partially lectotypified *E. officinalis* by equating it with the element regarded as *E. rostkoviana*, but nevertheless rejected the name *E. officinalis* as a nomen ambiguum, a view subsequently reiterated by Yeo (1972, 1978).

This rejection of the name *E. officinalis* was presumably based on Article 69 of the *International Code of Botanical Nomenclature*, which formerly stated, "A name is to be rejected if it is used in different senses and has so become a long-persistent source of error" (Stafleu *et al.* 1972). For those who took a broad view of *E. officinalis* and who would consider the two elements of the Linnaean sheet as representing variants of a single species, the application of the name was clear. It could be used for the aggregate species without further qualification. For those who recognised a number of species within the Linnaean concept, the name *E. officinalis* was not to be used for any of the segregates. While this interpretation of Article 69 was perhaps questionable, the result of this interpretation has been unambiguous and convenient.

Unfortunately, from this viewpoint, such a treatment is no longer tenable. Article 69 was altered at the International Botanical Congress in Leningrad in 1975 (Stafleu *et al.* 1978) and a name may now be rejected under this article only if "it has been widely and persistently used for a taxon or taxa not including its type" (Article 69.1) (Greuter *et al.* 1988). Further, a name may not be summarily rejected under this article; a name becomes formally rejected only after consideration by the General Committee established by the International Association for Plant Taxonomy and its placement on the list of nomina rejicienda (Articles 69.1, 69.2). To date, *E. officinalis* has not been so treated, and it is clear that there is no basis for doing so. While it is true that some early literature used the name in a sense that excluded the *E. rostkoviana* group, such misapplication has hardly been widespread or persistent. Virtually all use of *E. officinalis* has been in a broad sense that includes the type material. To interpret Article 69 in any other way would require the rejection of the names of all taxa that have been subdivided. The term nomen ambiguum has no formal meaning

under the *I.C.B.N.* and, in its usual meaning, it can hardly be applied to a name of undisputed modern application and for which there is accessible and reasonably good type material. It follows that the name *E. officinalis* is valid and would have priority over the name *E. rostkoviana* if they were shown to refer to the same taxon.

This situation has already been briefly pointed out by Barker (1982), but seems otherwise to have been generally overlooked or ignored. I have been as guilty as anyone for long maintaining a treatment that I knew to be invalid, but in the course of determining material and in preparing a semi-popular account of the British diploid taxa (Silverside 1990), I have increasingly come to doubt the validity of maintaining *E. anglica* Pugsl. as a separate species from *E. rostkoviana*. It has been clear that a new combination cannot be published until the nomenclature of the *E. rostkoviana* group has been revised, and a re-examination of the Linnaean material has seemed prudent.

It should be noted that although I have referred above to the publication of Sell & Yeo (1970) in relation to the lectotypification of *E. officinalis*, they did not, in fact, indicate a specimen, either in their publication or, apparently, at **LINN**. While there can be no reasonable doubt as to which of Linnaeus's specimens they considered as representing *E. rostkoviana*, I consider the unequivocal lectotypification to have been provided by Yeo (1978, p. 237), when he excluded the specimen with seven pairs of branches and eglandular foliar hairs. While this still leaves a choice of two specimens, I believe that these represent a single collection, as discussed below, and that they count as "small herbaceous plants", so being jointly acceptable as the type under Article 9.1.

EXAMINATION OF THE LINNAEAN MATERIAL OF *E. OFFICINALIS*

Although the two specimens that constitute the lectotype of *E. officinalis* have been declared to represent the taxon generally known as *E. rostkoviana*, it should be borne in mind that Yeo (1972, 1978) incorporated two taxa of eastern Scandinavia and northern Russia, *E. fennica* Kihlman and *E. onegensis* Cajander, within his concept of *E. rostkoviana* subsp. *rostkoviana*. These two taxa have been variously treated in Scandinavian literature, with recent viewpoints being to treat them both as named varieties of *E. rostkoviana* (Jalas 1977) or to treat *E. fennica* as a subspecies of *E. rostkoviana*, and *E. onegensis* as a taxon of uncertain status, perhaps closer to *E. hirtella* Jordan ex Reuter (Karlsson 1982). The Linnaean specimens were examined with these taxonomic and nomenclatural implications in mind.

As has been stated by previous workers, the Linnaean sheet 759.2 consists of three specimens. The left- and right-hand specimens bear long, glandular hairs while the central specimen is apparently eglandular, possesses seven pairs of branches and is clearly the specimen excluded from the lectotype by Yeo (1978). The following descriptions were necessarily made without risk of damage to the material and measurements are in some cases approximate or insufficient to allow ranges to be quoted.

THE CENTRAL SPECIMEN

Plant exceeding 18 cm in height (specimen curved in pressing), erect, with seven pairs of ascending branches, the lowest almost equalling the main stem; secondary branches absent; flowering commencing at node 12. Foliage with no trace of original colour but drying darker than the other two specimens on the sheet; undersides of leaves apparently paler than the uppersides; cauline leaves missing or fragmentary, with all teeth apparently antrorse and acutely triangular. Lower cauline internodes c. 10–12 mm; uppermost cauline internode 14 mm, its subtending leaf approximately 10 mm in length; lowest floral internode 11 mm, its subtending floral leaf c. 6 mm. Floral leaves broadly ovate to trullate, with mostly five pairs of antrorse, finely acute to aristate teeth. Foliage and calyces sparingly setose, lacking stalked glands. Calyx teeth linear-triangular, aristate. Corolla length (to tip of upper lip) c. 6·5 mm; lower lips with rather narrow, spreading lobes. Mature capsules c. 5·0 mm in length, about equalling calyx and subtending floral leaf; apex emarginate, ciliate; width 1·9 mm.

The symbol c is written on the sheet next to this specimen, which, following Savage (1945), indicates that the specimen is probably of Russian origin.

Pugsley (1930) referred to the identifications of this specimen as *E. nemorosa* but considered that it was more probably *E. curta*. As the specimen is only sparingly setose, he presumably had in mind

the subglabrous variants that have been recognised as *E. curta* var. *glabrescens* Wettst., though Pugsley did not, himself, accept this taxon. Yeo (1971) considered that there is no difference between *E. curta* var. *glabrescens* and *E. nemorosa* and that typical, Scandinavian *E. curta* is also best regarded as a hairy variant of *E. nemorosa*, though some populations in Britain, the Faeroes and Iceland he recognised as a separate species, *E. ostenfeldii* (Pugsl.) Yeo. The Linnaean specimen is certainly not *E. ostenfeldii* and there seems no basis to identify it with *E. nemorosa* var. *curta* Fries, as reinstated and illustrated by Hartl (1972). There remains the choice between *E. nemorosa* and *E. stricta*, which appear to be the only species that should be considered.

The specimen certainly bears a strong resemblance to *E. nemorosa*, particularly to the rather large, strongly branched variants sometimes met on waste ground. The corolla size indicates *E. nemorosa*, being considerably smaller than would be expected in *E. stricta*. However, the finely acute to aristate and apparently uniformly antrorse toothing of the leaves indicates *E. stricta* and the relatively narrow capsules perhaps also support this view. The leaves of *E. stricta* are commonly markedly paler beneath and there is perhaps some indication that this was true of the Linnaean specimen. Both taxa extend into the Soviet Union and since both tend to be outcrossing species and have rather similar habitat requirements, the possibility that the specimen came from a hybrid population cannot be ruled out. Karlsson (1984) notes the ready formation of hybrid swarms between the two species on the island of Gotland, Sweden. While, on balance, the specimen seems nearer to *E. stricta*, it is not, in my opinion, reliably identifiable, and amply illustrates the difficulty of dealing with single plants. Fortunately, its identity no longer has any nomenclatural implication.

THE LEFT-HAND SPECIMEN

Plant 28·2 cm in height, erect, with three pairs of branches in upper half; branches straight, ascending at about 30° from vertical, distinctly shorter than main stem; secondary branches absent; flowering apparently commencing at node 9. Foliage with no trace of original colour, drying light brown; cauline leaves missing. Lower cauline internodes long, exceeding 3 cm; lowest floral internode 1·2 cm. Lower floral leaves missing; middle and upper floral leaves reaching maximum length of 6 mm, broadly rhomboid-ovate, with five pairs of teeth on examinable leaves; toothing finely acute to aristate; all teeth antrorse. Foliage with some setose hairs; foliage, calyces and upper parts of stem also clothed in long-stalked, waved glandular hairs; lengths of glandular hairs variable, reaching 0·5 (−0·7) mm; stalks multicellular (to 4-celled), transparent; glandular heads globose to ellipsoid, transparent or now brown. Calyx teeth linear-triangular, ± aristate. Corolla length (to tip of upper lip, pressed) at least 8 mm; lower lip exceeding upper, with spreading lobes, width at least 5·5 mm; no glands noted on exposed part of corolla tube. Capsules variable in size, longest 5·2 mm, equalling or exceeding floral leaves, shorter than to equalling to exceeding calyx, width 2·1 mm; apex emarginate, ciliate.

THE RIGHT-HAND SPECIMEN

Plant 29·3 cm in height, erect, with two pairs of upcurved branches emerging at an angle of about 45° from the mid-part of the stem and distinctly shorter than the main stem; secondary branches absent; flowering probably commencing at node 9, but specimen has three intercalary nodes below this, now bare. Cauline leaves missing. Lower cauline internodes c. 2·5 cm; lowest floral internode 1·4 cm. Lower floral leaves to 9·5 mm in length, broadly rhomboid-ovate, with seven pairs of finely acute teeth, the lowest pair patent, the rest antrorse; floral leaves diminishing in size upwards; upper floral leaves with six pairs of teeth, all antrorse. Calyx teeth linear-triangular, ± aristate. Corollas appear equal in size to those of the left-hand specimen, no accurate measurements being possible. No mature capsules are present.

Foliage colour and details of setose and glandular indumentum are as described for the left-hand specimen.

DISCUSSION OF THE LEFT- AND RIGHT-HAND SPECIMENS

No indication of the origin of the specimens is given, but the general facies of the two specimens would support their being from a single collection. They differ somewhat in their branching, but branches tend to be rather flexuous and variable in the *E. rostkoviana* group, to which the specimens undoubtedly belong, and I consider these differences to be unimportant and no more than would be expected within a single population. So far as it is possible to compare foliage and corolla characters,

there is a close similarity between the two plants. In the following discussion, I assume that the two specimens are of common origin. In the absence of any indication to the contrary, they would seem most likely to be Swedish, a view for which there is support from the fine detail of their morphology, as discussed below.

At first sight, the specimens match *E. rostkoviana* closely. They are more branched than most material of *E. fennica* that I have seen but, on the other hand, they match the photograph of the lectotype material of *E. fennica*, published by Jalas & Kukkonen (1973), extremely well. The other possibility cited above, *E. onegensis*, can apparently be discounted. Little information was provided with its original description (Cajander 1901) and I know the taxon only from the photograph of lectotype material, again published by Jalas & Kukkonen (1973). However, this photograph shows a distinctive plant of aestival habit, with markedly small corollas, low flowering nodes, and large upper floral leaves, giving the developing plants a capitate appearance (much as in well grown *E. frigida* Pugsl.), and with leaves with few pairs of rather blunt teeth. Karlsson (1982) has investigated Finnish records of *E. onegensis* and has shown that they are referable to *E. fennica*, leaving *E. onegensis* as a taxon currently known only in the north-western part of the Soviet Union and needing further study. The Linnaean specimens clearly differ from the lectotype of *E. onegensis* and from Karlsson's redescription in such features as corolla size, lowest flowering node and shape and toothing of the floral leaves.

The differences between *E. rostkoviana*, particularly with regard to British and Irish material, and *E. fennica* seem, at first, so slight, that Yeo's (1972) inclusion of the latter taxon under *E. rostkoviana* subsp. *rostkoviana* has appeared, to me, fully justified. However, Karlsson's (1982) meticulous study of the complex in Sweden forces a reassessment of these taxa. Karlsson has shown that *E. fennica*, which he recognises as a subspecies of *E. rostkoviana*, is widespread in eastern Sweden, Finland and the adjacent part of the Soviet Union, often on relatively poor soils. *E. rostkoviana* (sensu stricto), by contrast, is largely restricted to two calcareous regions of Sweden, and is a recent and casual introduction in Finland. As well as in its slender, usually autumnal habit, *E. fennica* differs from Scandinavian and continental *E. rostkoviana* in its floral leaves, with more numerous (between five and eight) pairs of finer, narrower teeth and in the narrower mid-lobes of its lower corolla lips. Even in Karlsson's figures, there is only limited evidence of disjunction in these characters, but he argues convincingly for recognition of *E. fennica* at subspecific rank, and even that evolutionary differentiation of *E. fennica* from *E. rostkoviana* s.s. occurred at an earlier time than the differentiation of *E. rostkoviana* subsp. *montana* from the latter taxon. The opinion of a respected authority on the genus, based on detailed work in his own area, cannot be lightly disregarded and I accept his conclusions here.

Linnaeus's specimens fit *E. fennica* in habit and the floral leaves of the right-hand specimen, with their seven pairs of finely acute teeth, clearly fall within the range of *E. fennica* and outside the range of most or all *E. rostkoviana* from elsewhere. The single measurement of a width of a lower corolla lip (equalling or exceeding 5·5 mm, left-hand specimen) would infer a mid-lobe width unlikely to exceed 3 mm, which, while not conclusive, again strongly indicates *E. fennica*. I conclude that the lectotype material of *E. officinalis* matches the taxon currently known as *E. rostkoviana* subsp. *fennica* (Kihlman) Karlsson.

It may be noted that Karlsson found that *E. fennica*, in Sweden, occurs in greatest abundance in the vicinity of Uppsala, an area in which Linnaeus collected extensively (Blunt 1971) and hence the most likely origin of his material.

NOMENCLATURE

Since the name *E. officinalis* L. takes priority over both *E. rostkoviana* Hayne and *E. fennica* Kihlman, the following nomenclatural arrangement is required.

Euphrasia officinalis L., *Sp. Pl.* 604 (1753).
LECTOTYPE: Sheet 759.2, Herb. Linnaeus (**LINN**), excluding specimen with seven pairs of branches (Yeo 1978).

1) **E. officinalis** L. subsp. **officinalis**
E. fennica Kihlman, in Mela, *Suomen Koulukasvio, 4th ed.*, 247 (1899).

E. rostkoviana Hayne var. *fennica* (Kihlman) Jalas in *Ann. Bot. Fenn.* **14**: 191 (1977),
E. rostkoviana Hayne subsp. *fennica* (Kihlman) Karlsson in *Växtekologiska Studier* **15**: 42 (1982).

Fuller synonymies are provided by Jalas & Kukkonen (1973) and Karlsson (1982). Distribution: Eastern Fennoscandia and adjacent parts of the Soviet Union.

As inferred in the foregoing discussion, some British and Irish populations resemble this subspecies, and *E. fennica* was reported from Exmoor and Galway by Bucknall (1917). Pugsley (1930) doubted these identifications, but mentioned other Irish material that resembled it. Material I have seen matches subsp. *rostkoviana* in the floral leaves with four to five pairs of rather coarse teeth and is undoubtedly referable to that subspecies, though showing some differentiation from continental populations.

2) **E. officinalis** L. subsp. **rostkoviana** (Hayne) F. Townsend, in *J. Bot., Lond.* **22**: 165 (1884). (As *E. officinalis* L. **E. Rostkoviana*, but with indication that the rank of subspecies was intended.) LECTOTYPE: not designated. The plate accompanying Hayne's description shows a plant possessing floral leaves with five pairs of coarse teeth, consistent with the taxonomic views adopted in this paper.
E. rostkoviana Hayne, *Getreue Darstellung und Beschreibung der in der Arzneykunde Gebräuchlichen Gewächse* **9**: t.7 (1825).

Distribution: throughout most of Europe, including Britain and Ireland; rare in Scandinavia.

It is pleasing that what I take to be the correct combination at subspecific rank maintains the continuity of use of the familiar epithet, *rostkoviana*. However, there is a potential problem in the existence of the combination *Euphrasia officinalis* L. A) *E. pratensis* Fries, *Novitiae florae Suecicae, edit. altera* 198 (1828), which could be regarded as invalidly published (*I.C.B.N.* Articles 32.1b and 33.4) but which may also be regarded as legitimate under Article 24.4. It is clear in the context of Fries' account that his use of upper case lettering was to denote a concept above that of variety, but which he clearly stated he did not wish to distinguish as separate species. His concept seems to match that of the subspecies but is not explicitly stated. Under Articles 24.4 and 35.2, he can thus be taken to have validly published an infraspecific taxon of undefined rank, under which he lists, as a synonym, *E. rostkoviana* (as "*Rostkowiana*").

He separated his "A) *E. pratensis*" from his other subdivision, "B) *E. montana*", by the former being glandular hairy. As well as his very brief description of *pratensis* and citation of *E. rostkoviana*, he also referred to the pre-Linnaean description of Haller (1745). Reference to Haller's work (p. 240) shows that under "*Euphrasia officinarum*" he listed two taxa, "*Euphrasia ramosa, pratensis, flore albo*" and "*Euphrasia minus ramosa, flore ex caeruleo purpurascente*". The first of these would appear to correspond to Fries' *pratensis*, while the second must then correspond to Fries' parallel reference to Haller under "B) *E. montana*". In fact, this is of little help in interpreting the application of Fries' names.

Although Fries included *E. rostkoviana* in his concept of "A) *E. pratensis*", it seems clear that he must also have included the glandular component of the complex that Karlsson (1976) groups under *E. stricta* and which Yeo (1972, 1978) splits between *E. stricta* (including *E. brevipila* Burnat & Gremli ex Gremli) and *E. arctica* Lange ex Rostrup subsp. *tenuis* (Brenner) Yeo. Populations of this complex are widespread and locally abundant in Scandinavia and Fries could hardly have overlooked these attractive and conspicuous plants. Taking the whole of Fries' protologue, there is no justification, at present, for equating his *pratensis* with *E. rostkoviana* and I consider his "A) *E. pratensis*" to be a nomen dubium. Should a future lectotypification of *pratensis* be based on material referable to *E. rostkoviana*, Fries' combination, even if validly published, would still not, itself, have any status in questions of priority (Article 35.2). Nevertheless, the epithet *pratensis* was widely taken up, numerous citations being given by Wettstein (1896). Although it is possible that a valid combination at subspecific rank exists and predates Townsend's combination, the earliest such relevant use of the epithet *pratensis* appears to be *E. Rostkoviana* Hayne subsp. *pratensis* Ascherson & Graebner, *Flora des nordostdeutschen Flachlandes (ausser Ostpreussen)*: 644 (1899), which is invalid under Article 26.1 and would, in any case, become a later homonym if transferred to *E. officinalis* (Article 64.4).

3) **E. officinalis** L. subsp. **monticola** Silverside, **nom. nov.**, pro *Euphrasia montana* Jordan, *Pugillus plantarum novarum praesertim gallicarum* 132 (1852); non *E. officinalis* L. var. *montana* (Fries)

Fries, *Summa vegetabilium scandinaviae* 19 (1845). TYPE: in **herb. Jordan**, inaccessible and not seen by me; see Yeo (1978).
E. rostkoviana L. subsp. *montana* (Jordan) Wettst. in *Denkschr. Akad. Wiss., Wien* **70**: 319 (1901).
E. rostkoviana L. subvar. *montana* (Jordan) Hartl, *Illustrierte Flora von Mitteleuropa*, 2nd ed. **6(1,5)**: 349 (1972).
Non *E. montana* Phillipi, *Plantas nuevas Chilenas* 116 (1896).

Distribution: scattered throughout much of central and northern Europe, including Britain, mainly in upland areas and typically in damp meadows and pastures; undoubtedly declining through drainage and changes in land-use.

Article 64.4 of the *I.C.B.N.* prohibits the use of the same epithet for different infraspecific taxa, not based on the same type, within the same species, even if they are of different rank. The use of the name *E. officinalis* in a broad sense has resulted in a host of infraspecific taxon names and, in this case, the existence of *E. officinalis* var. *montana* prevents any such combination based on *E. montana* Jordan. Fries' var. *montana* is validated by indirect reference to his earlier description (Fries 1828), under *E. officinalis* B) *E. montana*, even if this latter construction is not itself taken to be validly published, for reasons discussed above in relation to his *E. officinalis* A) *E. pratensis*.

A new epithet has been required and I have chosen an epithet that in both form and meaning is close to the original and should minimise the inconvenience of the change of name.

In his account of *E. rostkoviana*, Wettstein (1896) mentioned *E. uliginosa* Ducommun. Although Wettstein recognised *E. montana* separately, a variant of *E. rostkoviana* from a damp habitat has seemed to need further investigation as a possible synonym and source of epithet. However, although I have seen neither the original description nor any original material of *E. uliginosa*, it is clear from the accounts of the genus in Reuter (1861) and Ducommun (1869) that *E. uliginosa* was regarded as a small-flowered, late-flowering taxon, which both authors justifiably maintained separately from *E. montana*. The illustration of this taxon in Hayek & Hegi (1913: fig. 54) is referable to subsp. *rostkoviana* and in the second edition of this work (Hartl 1972: fig. 175), the caption is duly altered to "subvar. *Rostkoviana*".

4) **E. officinalis** L. subsp. **anglica** (Pugsl.) Silverside, **comb. et stat. nov**. LECTOTYPE: Box Hill, Surrey, 22nd September 1920, *Pugsley 440* (**BM**) (Pugsley 1930; Yeo 1978).
Euphrasia anglica Pugsley in *J. Bot., Lond.* **67**: 225 (1929).

Distribution: Britain, Ireland and perhaps also in the neighbourhood of Rouen, France (Yeo 1978), usually in damp, heathy, grazed grassland.

Subsp. *anglica* is at its most distinct in south-western England, where it occurs in the apparent absence of subsp. *rostkoviana*. Essentially a plant adapted to withstand grazing, it differs from subsp. *rostkoviana* in its shorter lower-internodes and more basal branching, its smaller corollas and in its frequently more rounded and rather darker leaves. As emphasised by Pugsley (1930), the rather larger floral leaves, decreasing less in size upwards, are characteristic of subsp. *anglica*, and contribute to the distinctive appearance of many populations. However, when one considers plants from other parts of western Britain and from Ireland, these characters become less reliable. Much Welsh material, in particular, is intermediate in nature and can be named only with difficulty (and then perhaps arbitrarily). Herbarium material of more upright, narrower-leaved plants has sometimes been named as *E. anglica* var. *gracilescens* Pugsl., though such specimens do not match the type, from Myrtleberry Cleave, N. Devon, *W. C. Barton 277* (**BM**).

While subsp. *anglica* is recognisable northwards to southern Scotland, with Mrs O. M. Stewart having found small, but quite characteristic material at a cluster of sites in Galloway, it is clear that in much of its range, subsp. *anglica* is not fully differentiated from subsp. *rostkoviana*. While it is likely that, as elsewhere in the genus, difficulties arise principally through hybridisation following breakdown of habitat barriers through man's activities, the two taxa are clearly so closely allied that it is best to consider *E. anglica* as a localised derivative of subsp. *rostkoviana*. Subspecific status of *E. anglica* appears most appropriate.

STATUS OF RELATED TAXA

Species concept in *Euphrasia* is currently a matter for some debate. Hartl's (1972) account of the genus in central Europe treats at lower rank some taxa recognised as species by Yeo (1972).

Karlsson (1976) proposed rather more sweeping revisions. As pointed out by Sell & Yeo (1970), while there is a biological argument for accepting a greatly reduced number of species, this would lead to a cumbersome infraspecific nomenclature. While I agree broadly with Karlsson's view that the number of taxa given specific status could be greatly reduced, it is also clear that any reduction should be based on careful consideration of taxa over the whole of their ranges and should aim to clarify relationships rather than be based on superficial similarities.

Against this background of debate, I have given some consideration to the status of two other glandular species, the diploid, *E. vigursii* Davey, and the presumed diploid, *E. campestris* Jordan. *E. vigursii* is endemic to south-western England, where it is a strikingly attractive plant characteristic of *Agrostis curtisii* Kerguélen heathlands. There is good reason to believe that it has originated by hybridisation between *E. officinalis* subsp. *anglica* and the tetraploid species *E. micrantha* Reichenb. (Yeo 1956).

Yeo (1972) treated *E. campestris* as a subspecies of *E. rostkoviana*, occurring in dry grassland from Belgium to Italy. In his account, Yeo (1978) accepted a somewhat wider distribution and regarded *E. campestris* (still as a subspecies) as being of polytopic origin, derived in some cases directly from subsp. *rostkoviana* and in other cases through introgression from tetraploid species, including *E. stricta*. Accordingly, he regarded it as one end of a range of variation, defined rather arbitrarily by small leaves and late-flowering habit.

While I readily admit that Dr Yeo has examined considerably more material than I have done, I do not entirely agree with his views. *E. campestris* has occasionally been reported in Britain, such records having been treated by Pugsley (1930) as referring to hybrids between *E. anglica* or *E. rostkoviana* and tetraploid species such as *E. nemorosa*, a conclusion with which I agree. I have recently compared a distinctive collection by T. G. Evans from a limestone site in the Wye Valley (**herb. T. G. Evans**) with a range of *E. campestris* material and, while I concluded that the Wye Valley collection, along with other British candidates for "*campestris*", should be regarded as *E. officinalis* × *nemorosa* (the latter probably as var. *calcarea* Pugsl.), I feel the same could be said for a number of continental specimens. There is a nucleus of material characterised by commencing to flower at a high node, usually at node twelve or above, rather short upper internodes, rather numerous, stiff, straight branches emerging high on the stem and held at an angle of around 30° from vertical, distinctly small floral leaves (range not noted but probably rarely exceeding 7 mm) with noticeably acute to aristate toothing and flowers arranged in strict pairs. While I have not seen type material, I take this nucleus to represent the true *E. campestris*, a distinctive taxon that, as suggested by Yeo (1972) in his earlier account, has probably arisen by hybridisation with *E. stricta*.

The two taxa, *E. vigursii* and *E. campestris*, are, therefore, comparable in origin and should be similarly treated. While I would not argue with their being treated as subspecies of *E. officinalis*, they are inherently different in nature from the other taxa here so treated, and, for the present, I prefer to retain them at specific rank.

The remaining British species of series *Euphrasia* is *E. rivularis* Pugsl., endemic to mountain flushes in Wales and the Lake District. As I have suggested elsewhere (Silverside 1990), this may also be of hybrid origin, perhaps originally derived from *E. officinalis* subsp. *rostkoviana* crossing with *E. micrantha*, but with further adaptation to its restricted habitat. While its distinctiveness may be obscured locally by hybridisation with *E. officinalis* subsp. *rostkoviana*, I consider it a good species in the current context of *Euphrasia* taxonomy.

INFRAGENERIC CLASSIFICATION

The genus *Euphrasia* is typified by *E. officinalis*. Barker (1982) gives useful discussion. Article 22.1 of the *I.C.B.N.* now requires that any subdivision of a genus containing the type species of that genus takes the same name as the genus. This means that all generic subdivisions containing *E. officinalis* must take the epithet *Euphrasia*, without author citation. The following changes are required from the treatments by Pugsley (1930) and Yeo (1978). Details of typification are taken from Yeo (1978).

Section *Euphrasia* — Pugsley: sect. *Semicalcaratae* Bentham (but see Sell & Yeo (1970) regarding author citation). Yeo: sect. *Euphrasia*.

Subsection *Euphrasia*	Pugsley: subsect. *Ciliatae* Jørgensen (Lectotype: *E. scottica* Wettst.) Yeo: subsect. *Ciliatae* Jørgensen.
Series *Euphrasia*	Pugsley: series *Hirtellae* Pugsley (Type: *E. hirtella* Jordan ex Reuter) Yeo: series *Grandiflorae* Wettst. (Lectotype: *E. rostkoviana* Hayne)

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REFERENCES

Barker, W. R. (1982). Taxonomic studies in *Euphrasia* L. A revised infrageneric classification, and a revision of the genus in Australia. *J. Adelaide Bot. Gard.* **5**: 1–304.

Blunt, W. (1971). *The compleat naturalist. A life of Linnaeus*. London.

Bucknall, C. (1917). British *Euphrasiæ*. *J. Bot., Lond.* **55** (Suppl.): 1–29.

Cajander, A. K. (1901). *Euphrasia onegensis* n. micrsp. *Meddel. Soc. pro Fauna et Flora Fennica 1900–1901*: 101–102.

Ducommun, J. C. (1869). *Taschenbuch für den schweizerischen Botaniker*. Solothurn.

Fries, E. M. (1828). *Novitiae florae Suecicae, edit. altera*. Lund.

Greuter, W., *et al.* (1988). *International code of botanical nomenclature adopted by the Fourteenth International Botanical Congress, Berlin, July–August 1987*. Königstein.

Haller, A. (1745). *Flora Ienensis*, 3rd ed. Jena.

Hartl, D. (1972). *Euphrasia*, in Hartl, D. & Wagenitz, G., eds. *G. Hegi illustrierte Flora von Mitteleuropa*, 2nd ed. **6(1,5)**: 335–373. Munich.

Hayek, A. von, & Hegi, G. (1913). *Euphrasia*, in Hegi, G., ed. *Illustrierte Flora von Mittel-Europa*, **6(1)**: 83–100. Munich.

Jalas, J. (1977). New nomenclatural combinations in *Euphrasia*, *Rumex*, *Silene* and *Stachys*. *Ann. Bot. Fennici.* **14**: 191–192.

Jalas, J. & Kukkonen, I. (1973). Typification of the taxa of *Euphrasia* (Scrophulariaceae) described by Finnish botanists. *Ann. Bot. Fennici.* **10**: 27–42.

Karlsson, T. (1976). *Euphrasia* in Sweden: hybridization, parallelism and species concept. *Bot. Notiser.* **129**: 49–60.

Karlsson, T. (1982). *Euphrasia rostkoviana* i Sverige. *Växtekologiska Studier*. **15**. Uppsala.

Karlsson, T. (1984). Early-flowering taxa of *Euphrasia* (Scrophulariaceae) on Gotland, Sweden. *Nord. J. Bot.* **4**: 303–326.

Pugsley, H. W. (1930). A revision of the British *Euphrasiæ*. *J. Linn. Soc. Lond. (Bot.)* **48**: 467–544.

Reuter, G. F. (1861). *Catalogue des plantes vasculaires qui croissent naturellement aux environs de Genève*. Geneva.

Savage, S. (1945). *A catalogue of the Linnaean Herbarium*. London.

Sell, P. D. & Yeo, P. F. (1970). A revision of the North American species of *Euphrasia* L. (Scrophulariaceae). *Bot. J. Linn. Soc.* **63**: 189–234.

Silverside, A. J. (1990). A guide to eyebrights (*Euphrasia*). II The *E. rostkoviana* group. *Wild Flower Mag.* **418**: 31–34.

Stafleu, F. A., *et al.* (1972). *International code of botanical nomenclature adopted by the Eleventh International Botanical Congress, Seattle, August 1969*. Utrecht.

Stafleu, F. A., *et al.* (1978). *International code of botanical nomenclature adopted by the Twelfth International Botanical Congress, Leningrad, July 1975*, Utrecht.

Townsend, F. (1897). Monograph of the British species of *Euphrasia*. *J. Bot., Lond.* **35**: 321–336, 395–406, 417–426, 465–477.

Wettstein, R. von (1896). *Monographie der Gattung Euphrasia*. Leipzig.

Yeo, P. F. (1956). Hybridisation between diploid and tetraploid species of *Euphrasia*. *Watsonia* **3**: 253–269.

Yeo, P. F. (1971). Revisional notes in *Euphrasia*. *Bot. J. Linn. Soc.* **64**: 353–361.

Yeo, P. F. (1972). *Euphrasia* L., in Tutin, T. G. *et al.*, eds. *Flora Europaea* **3**: 257–266. Cambridge.

Yeo, P. F. (1978). A taxonomic revision of *Euphrasia* in Europe. *Bot. J. Linn. Soc.* **77**: 223–334.

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Polygonum lichiangense W. Smith: rejected as a naturalized British species

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ABSTRACT

Despite published records suggesting that *Polygonum lichiangense* W. Smith (Polygonaceae) has occurred as a naturalized alien in Britain, it is now realized that these are erroneous and arise from confusion with *P. polystachyum* Meissner var. *pubescens* Meissner (in Wales) and *P. campanulatum* Hook.f. (in Cornwall). The bases for these misconceptions are explored, and the characters distinguishing *P. lichiangense* from the two other taxa described.

INTRODUCTION

It has been alleged, mistakenly, on at least two occasions, that *Polygonum lichiangense* W. Smith has occurred as a naturalized garden escape in Britain (Lousley & Kent 1981; Murphy 1988). It would seem useful therefore to outline the reasons for these mistakes and to indicate some of the salient features which distinguish this species from those easily confused with it.

Polygonum lichiangense was described in 1914 from material collected in August 1910 by George Forrest (*6296*, **E**) in Western China (Lichiang Range, Yunnan) on his second expedition (Smith 1914; Cox 1945) (Fig. 1). Although once cultivated in the Royal Botanic Garden, Edinburgh, but now lost (D. G. Long pers. comm., 1989), it is still grown by D. McClintock at Platt in Kent, from a root obtained many years ago from the Royal Botanic Garden, Edinburgh, bearing the Forrest number *6070* (raised from seed collected in July 1910 from a locality somewhat to the south of *F 6296*). According to Kent (Lousley & Kent 1981, p. 81) it has been "cultivated in British gardens for about 60 years". It was in cultivation at the Royal Botanic Gardens, Kew, in 1952 (**K**, C46). A second, inadvertant, introduction happened when a "plant came up in soil in which plants of *Primula sonchifolia* were imported from Burma in 1933". Grown by Tom Hay, it gained a Royal Horticultural Society Award of Merit in 1933 (Chittenden 1934, p. 306; Cowan 1952, p. 213).

The alleged occurrence of *Polygonum lichiangense* in Wales and in Cornwall, stems from confusion with two other species of *Polygonum* widely naturalized in the British Isles: firstly with *P. polystachyum* Meissner to which Smith (1914) considered his *P. lichiangense* was closely related, and secondly with *P. campanulatum* Hook.f. to which species Steward (1930) transferred the Chinese plant as a variety – var. *lichiangense* (W. Smith) Steward. This latter (misleading) assignment has been followed in, for example, the *Supplements* to the *Dictionary of Gardening* (Stearn 1956, p. 299; 1969, p. 467) and in the *European Garden Flora* (Akeroyd 1989, p. 128).

ALLEGED NATURALIZATION OF *POLYGONUM LICHIANGENSE*

The first alleged naturalization of *P. lichiangense* was in the 1970s from Pembs. (v.c. 45) (cf. Lousley & Kent 1981), but Ellis (1983) indicated that this record, as well as one from Merioneth (v.c. 48), was erroneous. They arose from confusion with the 'hairy' variant of *P. polystachyum*, var. *pubescens* Meissner, to which these records refer (Conolly 1977).

The second alleged occurrence was an E. Cornwall (v.c. 2) plant reported (though not determined) by Murphy (1988, p. 24) as "*Polygonum campanulatum* var. *lichiangense*", a taxon "thought to be not previously recorded as a garden escape". It was growing beside a stream near St Ann's Chapel (GR 20/40.70). This stand has now been re-examined (Oct. 1989), and, although pale

FIGURE 1. The lectotype of *Polygonum lichiangense* W. Smith, *Forrest 6296* (**E**), from eastern flank of Lichiang Range, Yunnan, China. The specimen shows the long ochreae (central stem) and the woody base.

in colour, agrees with the usual variant naturalized in this country, *P. campanulatum* var. *fulvidum* Hook.f., and is clearly distinct from genuine *P. lichiangense* as represented by the lectotype *Forrest 6296* (**E**) and by specimens of *Forrest 6070* (**E**) and by the clone in McClintock's garden at Platt, Kent (**LTR**). The differences, however, are not clearly explained in the more readily obtained literature.

REASONS FOR MISIDENTIFICATION

When one looks at the original description of *P. lichiangense* (Smith 1914) it is easy to see how the first of these misunderstandings arose. Smith emphasised the setose stipules (ochreae), as well as the dense grey tomentose undersurface of the leaves, as distinguishing the Lichiang plant from the closely related *P. polystachyum*; but he failed to point out, or more likely was ignorant of, the pubescent variant *P. polystachyum* var. *pubescens* in which the ochreae *are* indeed conspicuously setose, bearing buff hairs, unlike the glabrous ones in the more usual (in Britain) morph. In addition to pubescent stems and petioles, the leaves of this hairy variant are clothed in a velvety pubescence, especially on the undersurface; and, although this last character can not strictly be termed a 'tomentum', it is apparent that a lack of knowledge of this var. *pubescens* could readily lead to its being misidentified as *P. lichiangense*. This could happen using the key in *Docks and Knotweeds of the British Isles* (Lousley & Kent 1981, p. 20).

The basis for the confusion with *P. campanulatum* is more complex, and follows from a sequence of selective quoting of characters without reference to full diagnoses. It originates primarily with Steward (1930) who seemed to consider that those same features highlighted by Smith (setose stipules and grey tomentum) as the main distinction of *P. lichiangense* from the allied *P. polystachyum*, merited instead, placing it "very close to *P. campanulatum* var. *fulvidum*". He thus distinguished the Lichiang plant from this latter variety by only three characters: the grey (as opposed to *fulvous*) tomentum on the under-face of the leaf-blades, the ochreae being "coarsely brown-strigose", and the "pubescence of the upper surfaces of the leaf-blades set in basal glands" (a character which in fact also applies equally to *P. polystachyum* var. *pubescens*). Steward thus implied the quite false assumption that, in all other characters (including those of the perianth), var. *lichiangense* agreed with *P. campanulatum*.

Subsequently, although a full and accurate description for *P. lichiangense* as a species was published in the *Dictionary of Gardening* (Synge 1956, p. 1628), in the later *Supplements* (Stearn 1956, p.299; 1969, p. 467) Steward's reduction of *P. lichiangense* to a variety of *P. campanulatum* was taken up again. This is the case too in the recent *European Garden Flora* (Akeroyd 1989). Both authors select merely the colour of the flowers (white), and of the indumentum (greyish or with white hairs), as the only two features to distinguish the var. *lichiangense* from typical *P. campanulatum*.

The possible consequent assumption, that in all other respects this variety is identical with *P. campanulatum*, can explain the mis-naming of the Cornish plant. For here, in deep shade, most flowers (Oct. 1989) were indeed white, and only a few showed the usual pink hue. Here too, the tomentum under the leaves had retained the grey-white colour typical of younger leaves and only the oldest showed the mature 'fulvous' buff colour. This, a change with age, is considered a normal sequence (R. J. Murphy pers. comm., 1989). Indeed the distinction of var. *fulvidum* from the type variety has now been abandoned, and Hara *et al.* (1982, p. 172) have reduced var. *fulvidum* to a synonym of *P. campanulatum* var. *campanulatum*.

DISTINGUISHING CHARACTERS OF *P. LICHIANGENSE*

Examination of the lectotype of *P. lichiangense* (*Forrest 6296*, **E**), of *Forrest 6070* (**E**), and herbarium (**LTR**) and fresh material from Platt, Kent (*Forrest 6070*), as well as reference to Smith's full description (1914) reveal a number of features which distinguish this species both from *P. polystachyum* var. *pubescens* and from *P. campanulatum*: in particular the form of the perianth, the shape, size and colour of the ochreae, and the detailed character of the indumentum of the leaf-blades. These are discussed below and uphold specific distinction for *P. lichiangense* – an opinion with which Hong (pers. comm., 1990) concurs.

PERIANTH

In *P. lichiangense* the cup-shaped perianth closely resembles that of *P. polystachyum* with two narrow outer, and three broad inner members all "cleft nearly to the base" (Smith 1914 for *P. lichiangense*; Hooker 1886 for *P. polystachyum*). In *P. campanulatum*, in contrast, the perianth is campanulate, i.e. bell-shaped, with the members only free in their upper part; the lower portion is tubular. Steward (1930) made no mention of this character in relation to his var. *lichiangense*; nor indeed did later authors. Smith's (1914) diagnosis makes it clear that the perianth members are like those of *P. polystachyum*. I can see little difference in the form of the perianth of *P. lichiangense* (*Forrest 6296*, *6070*) and that of *P. polystachyum*, apart from a slight difference in size. The perianth members in *P. lichiangense Forrest 6296* (type) are larger (c.4 to 4·5 mm or even 5 mm), those of *Forrest 6070* (**E**) somewhat shorter (c.3 mm to 3·5 mm, a few to 4 mm); in *P. polystachyum* they range 3·0 to 3·5 mm, occasionally to 4 mm, but often less than 3 mm. This size difference is emphasised by Hong (pers. comm., 1989). The very different perianth of *P. campanulatum* measures 3·5–4 mm. (All measurements were made on dry herbarium material.)

OCHREAE (STIPULES)

Smith's emphasis on the *setose* stipules as distinguishing his *P. lichiangense* from *P. polystachyum* only tallies with the more widespread (in Britain) essentially glabrous variant of the latter, in which the ochreae are without hairs; but in the var. *pubescens* they bear buff hairs precisely as in *P. lichiangense*. In both these species the ochreae are membranous, very long, narrowly lanceolate, with long attenuate tips and are brown/buff in colour. In *P. polystachyum* they may reach 4 or even 5 cm, in *P. lichiangense* often no more than 3 cm; they are mostly long-persistent in both species. This is in contrast to *P. campanulatum* where the much shorter distal portion of the ochreae is shed early, leaving a loose, broad sheath of c.1 cm in length with a more or less truncate margin; this sheath is white (or colourless) when fresh and beset with off-white hairs. Further shedding reduces the ochreae to a mere 1–2 mm collar and a conspicuous ring of hairs (but cf. Akeroyd (1989) who states "ochreae c.1 mm"). In *P. polystachyum* the distal part of the ochreae are eventually also shed, leaving an unevenly truncate sheath, which, even if pale when young, soon becomes buff.

LEAF-BLADE INDUMENTUM

Steward's (1930) reference to 'tomentum' on the leaf-blade lower (under) surface in *P. campanulatum* and in var. *lichiangense*, fails to distinguish the marked difference in the detailed character of the indumentum in these two taxa. In *P. campanulatum* the so-called 'tomentum' is merely a thin powdery layer – a weft of minute tangled threads too fine to distinguish individually except under high magnification (Fig. 2C). In *P. lichiangense* (Fig. 2A), in contrast, the indumentum forms a thick, woolly pile of crisped, coarse hairs readily discernible individually under a low magnification, and closely resembling that found in *P. weyrichii*. This tomentum is less dense in some specimens of *Forrest 6070*. The pubescent form of *P. polystachyum* differs again: there is no true tomentum, but a pubescence, usually dense, of individual, somewhat crooked, bent hairs oriented acroscopically, giving a velvety feel (Fig. 2E).

The hairs on the upper leaf-blade surface of *P. lichiangense* (Fig. 2B) have bulbous often coloured (glandular) bases set in pedestal-like raised multicellular supports. This feature is close to that found in *P. polystachyum* var. *pubescens* (Fig. 2F). Steward (1930) emphasised the "pubescence of the upper surfaces of the leaf-blades set in basal glands" as distinguishing his var. *lichiangense* from the type *P. campanulatum*. And indeed, the equivalent hairs in *P. campanulatum* do differ (Fig. 2D) for as well as being much coarser and stiffer, they are not glandular, and lack the pedestal-like base: only some having slightly raised green supporting cells. As in *P. polystachyum* var. *pubescens* these hairs are restricted to parallel bands between the prominent lateral veins. The angle of divergence of these with the mid-rib, some 45°, is in marked contrast with the broad angle (c.90°) seen in *P. polystachyum*. No such conspicuously parallel lateral veins are evident in *P. lichiangense*, the hairs being un-zoned. Under very high magnification (SEM) the surface ornamentation on these hairs differs in detail for the three taxa concerned (Figs. 3A, B, and C).

In *P. campanulatum* coarse bristle-like hairs resembling those of the upper leaf-blade surface cover the prominent veins on the under surface (Fig. 3D).

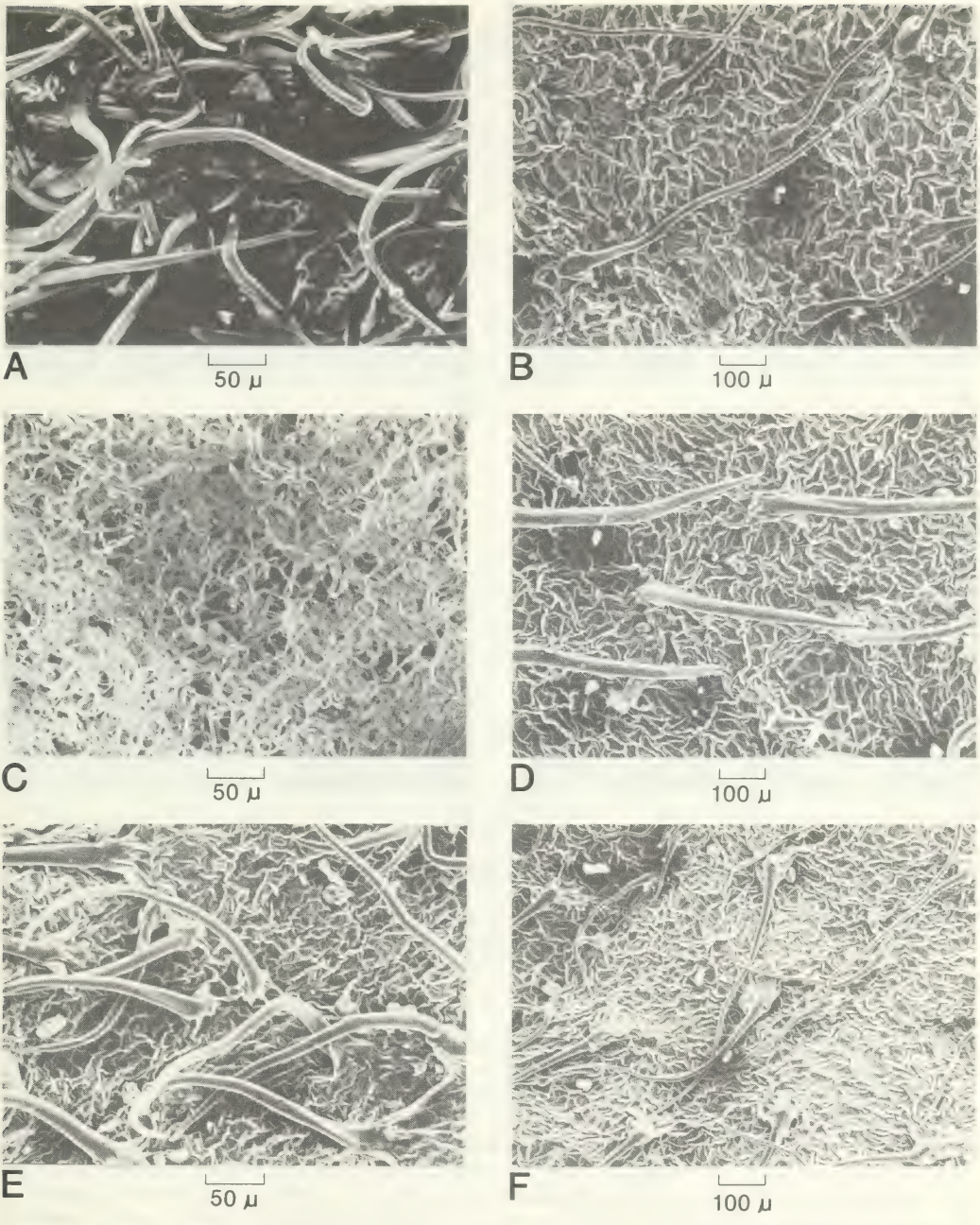

FIGURE 2. SEM photograph of leaf-blade surfaces to show indumentum in *Polygonum lichiangense* (A,B); *P. campanulatum* (C,D); and *P. polystachyum* var. *pubescens* (E,F). A,C,E abaxial surface; B,D,F adaxial surface. Same magnifications for abaxial surfaces; ditto for adaxial surfaces. Note: A, *P. lichiangense* crisped hairs obscuring abaxial epidermis; C, *P. campanulatum* fine tomentum of tangled threads; E, *P. polystachyum* var. *pubescens* isolated hairs not obscuring epidermis. B,F, *P. lichiangense* and *P. polystachyum* var. *pubescens* hairs with swollen bases on raised supporting pedestal. D, *P. campanulatum* bristle-like hairs with parallel orientation, on raised supporting cells. Source of material for SEM: *P. lichiangense*: (*Forrest 6070*) garden, Platt, Kent. *P. campanulatum*: St Ann's Chapel, E. Cornwall (GR 20/40.70). *P. polystachyum* var. *pubescens*: Rydal Water, Cumbria.

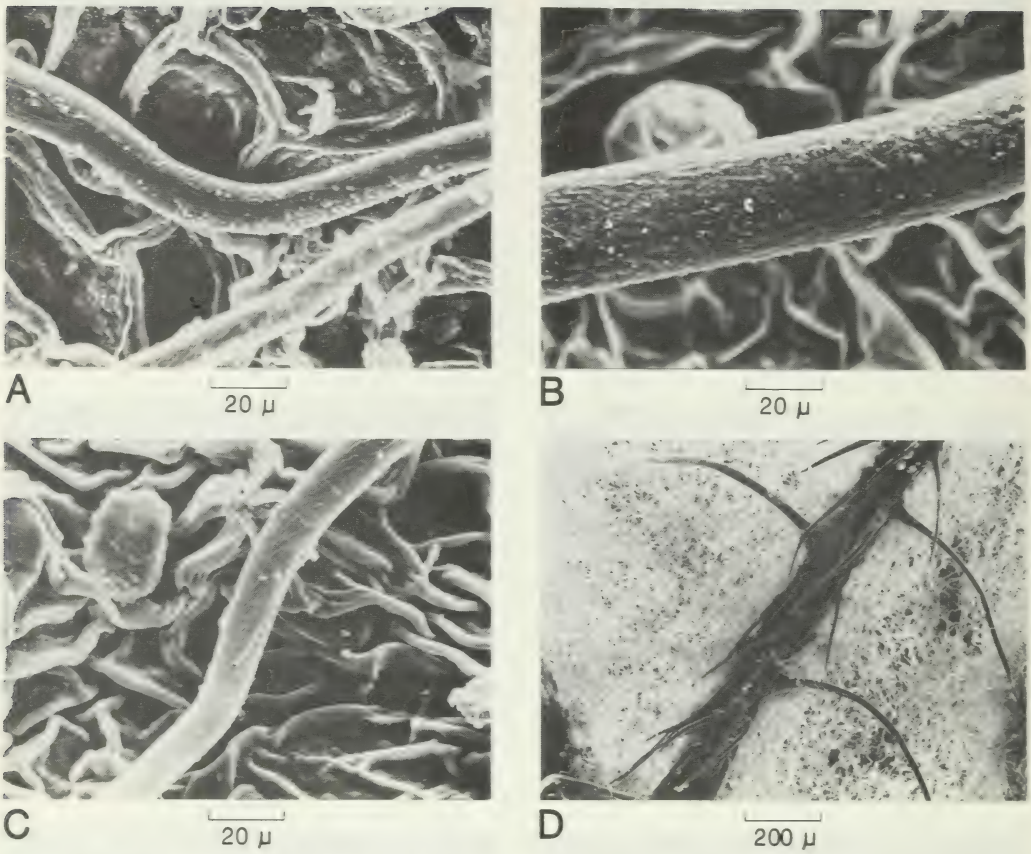

FIGURE 3. SEM photographs to show detail of ornamentation on hairs of adaxial leaf-blade surface: A, *P. lichiangense*: B, *P. campanulatum*: C, *P. polystachyum* var. *pubescens*. Note: ornamentation elongated, wavy in A; short, mound-like in B; and elongated spirally in C. D, abaxial surface of leaf-blade of *P. campanulatum* to show prominent hairs of vein. A, B, C, same magnification. Material: as in Fig. 2.

FURTHER FLORAL FEATURES

Another major difference between these taxa is that both *P. polystachyum* and *P. campanulatum* have dimorphic flowers: separate plants are either long-styled or short-styled; *P. lichiangense*, on the other hand, is apparently homostylous (but material from only three collections has been seen). The styles in *P. polystachyum* measure up to 1·0 (1·2) mm and 0·4 (0·5) mm respectively, and the stigmas are small and capitate or peltate. *P. campanulatum* is much the same. In *P. lichiangense* the three stigmas are *sessile* (no measurable length of style), and are obconical (funnel-shaped), a shape approaching that seen in *P. weyrichii* and some (but not all) other members of Section *Aconogonon*. This agrees with Král's (1985) illustration of the obconical sessile stigmas in *P. alpinum*, which he contrasted with the long styles of *P. polystachyum* – a contrast which would have been more dramatic had he illustrated a genuine long-styled flower and not the short-styled morph. Hong (pers. comm., 1989) has confirmed this feature in *P. lichiangense*. *P. lichiangense* is also distinguished by the anther colour which is pale creamy-fawn. The anthers in the other two species become very dark, almost black, but start violet-purple (*P. campanulatum*), or reddish-purple (*P. polystachyum*). The pollen appears white in both these species, in *P. lichiangense* almost transparent with a bluish tinge.

Smith (1914) did not observe mature fruit on his material of *P. lichiangense*. Material examined

(Platt, Kent, **LTR**) suggests a trigonous (or somewhat flattened), light-brown, shiny nut (achene) which does not protrude beyond the faded perianth. This fruit is not dissimilar to that formed (and then only extremely rarely from my observations) in *P. polystachyum*; although Akeroyd (1989) indicated "Fruit much longer than perianth". *P. campanulatum* also has an included nut, not 'exserted' as Steward (1930) wrote, nor truly winged when fully mature. Nor is the fruiting perianth consistently fleshy as Hara (1966, p. 632) implies; any thickening of the perianth seems to be a rare late-season development, and quite unlike *P. molle* whose spherical black fruit formed by the thick fleshy perianth around the enclosed nut, is shed as a unit. Such a 'baccate' fruit (Hooker 1886, p. 50) is a feature peculiar to *P. molle* s.l.

There are, of course, several other features distinguishing *P. lichiangense* which can be seen on perusal of herbarium material. Thus the strongly developed woody root-stock, without apparent sign of rhizomatous off-sets contrasts with *P. polystachyum* where these are abundant, and with *P. campanulatum* which has extensive prostrate stems. The overall shape and form of the leaves in *P. lichiangense* differs too, and is only approached by narrower-leaved examples of *P. campanulatum*, or by the small leaves on the inflorescence of *P. polystachyum*. The veining is quite unlike the prominent parallel form of the other two species. The form of the inflorescence is closer to that of *P. polystachyum*.

CONCLUSION

On several counts, *P. lichiangense* can be maintained as a species, clearly distinct from *P. campanulatum*, but less so from *P. polystachyum* var. *pubescens*, an opinion confirmed by Hong (pers. comm., 1989) and upheld by his investigation of pollen characters (Hong & Hedberg 1990). As yet there is no evidence that genuine *P. lichiangense* has escaped from cultivation in Britain. The assignment to a variety of *P. campanulatum* should be abandoned.

TAXONOMY AND NOMENCLATURE

The three species here discussed as species of *Polygonum* s.l. are commonly placed in the sect. *Aconogonon* Meissner. Hara (1966) followed Reichenbach (1837) who raised the section to a genus, *Aconogonum*. All three have valid names in that genus were this taxonomic split to be adopted (Hara 1966; Král 1969; Soják 1974). Furthermore all three have also been transferred to another segregate genus, *Persicaria* (Ronse Decraene & Akeroyd 1988; Gross 1913; Greuter & Raus (1989); and invalidly by Trehane (1989). The elevation of *P. polystachyum* to a separate genus (Král 1985) is not accepted here.

The following specimens of *P. lichiangense* have been seen:

1) Yunnan, West China. Lat. 27°40′N. Aug. 1910. *Forrest 6296* (**E**). Type *fide* W. W. Smith (Lectotype selected by S.-P. Hong). "Flowers creamy-white". (Isotype **BM**).
2) Yunnan, West China. Lat. 27°30′N. July 1910. *Forrest 6070* (**E**). "*Polygonum lichiangense* W. W. Sm. *var*. Flowers creamy yellow".
3) *Forrest 6070* ex Hort. R. B. G. Edin. 1911 (**E**). "*Polygonum* aff. *P. polystachyum* Wall. var. vel sp. nov.".
4) & 5). *Forrest 6070* ex Hort. R. B. G. Edin. via Garden at Bracken Hill, Kent. 29 Oct 1975, *D. McClintock* (**LTR**). *ditto*, 27 Sept. 1975, *D. McClintock* (**LTR**).
6) Royal Botanic Gardens, Kew. Cultivated. Aug. 1952. *C46* (**K**).
7) West China. Oct. 1933. *McLaren 231* (**K**).

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record my thanks to Miss R. J. Murphy for taking me to the Cornish plant, to the National Museum of Wales (per R. G. Ellis) for the loan of the negative of the type specimen, and to S.-P. Hong (Uppsala) for his comments from his unpublished thesis: also to the Natural History Museum, London, for facilities, and to Prof. C. A. Stace for taxonomic guidance.

REFERENCES

Akeroyd, J. R. (1989). *Polygonum* Linnaeus. in Walters, S. M. *et al.*, eds. *The European garden flora* **3**: 125–128. Cambridge.

Chittenden, F. J., ed. (1934). Plants to which awards have been made 1933–4. *J. R. Hort. Soc.* **59**: 300–307.

Conolly, A. P. (1977). The distribution and history in the British Isles of some alien species of *Polygonum* and *Reynoutria*. *Watsonia* **11**: 291–311.

Cowan, J. M., ed. (1952). *The journeys and plant introductions of George Forrest*. Oxford.

Cox, E. H. M. (1945). *Plant hunting in China*. London.

Ellis, R. G. (1983). *Flowering plants of Wales*. Cardiff.

Greuter, W. & Raus, Th., eds. (1989). Med-checklist notulae, 15. *Willdenowia* **19**: 41.

Gross, H. (1913). Remarques sur les Polygonées de l'Asie Orientale. *Bull. Acad. Int. Géogr. Bot.* **23**: 7–32.

Hara, H. (1966). *The flora of eastern Himalaya*. Tokyo.

Hara, H., Chater, A. O. & Williams, L. H. J. (1982). *An enumeration of the flowering plants of Nepal* **3**: 172. London.

Hong, S.-P. & Hedberg, O. (1990). Parallel evolution of aperture numbers and arrangement in the genera *Koenigia*, *Persicaria* and *Aconogonon* (Polygonaceae). *Grana* **29**: 177–184.

Hooker, J. D. (1886). *Flora of British India* **5**: 50. Ashford.

Král, M. (1969). *Aconogonon polystachyum* comb. n. *Preslia (Praha)* **41**: 258–260.

Král, M. (1985). *Rubrivena*, a new genus of Polygonaceae. *Preslia (Praha)* **57**: 65–67.

Lousley, J. E. & Kent, D. H. (1981). *Docks and Knotweeds of the British Isles*. B.S.B.I. Handbook No. 3. London.

Murphy, R. J. (1988). Plant notes and records, mainly 1987. *Botanical Cornwall Newsletter* **2**: 11–29.

Reichenbach, H. G. L. (1837). *Handbuch des naturlichen Pflanzensystems*. 236. Dresden & Leipzig.

Ronse Decraene, L-P. & Akeroyd, J. R. (1988). Generic limits in *Polygonum* and related genera (Polygonaceae) on the basis of floral characters. *Bot. J. Linn. Soc.* **98**: 321–371.

Smith, W. W. (1914). Diagnoses specierum novarum in herbario Hort. Regii Botanici Edinburgensis cognitum LI–CII (Species Chinensis). *Notes R. Bot. Gard. Edin.* **8**: 173–212.

Soják, J. (1974). Bemerkung zur Gattung *Truellum* Houtt. (Polygonaceae). *Preslia (Praha)* **46**: 139–156.

Stearn, W. T. (1956). *Polygonum* in Synge, P. M., ed. *Supplement to the Dictionary of Gardening*: 298–299. Oxford.

Stearn, W. T. (1969). *Polygonum* in Synge, P. M., ed. *Supplement to the Dictionary of Gardening*, **2**: 466–468. Oxford.

Steward, A. N. (1930). The Polygoneae of Eastern Asia. *Contr. Gray Herb. Harv.* **88**: 1–129.

Synge, P. M., ed. (1956). *Polygonum*. in *Dictionary of Gardening*, 2nd ed., **3**: 1627–1629. Oxford.

Trehane, P. (1989). *Index Hortensis*, **1**. Wimborne.

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Further observations on *Stachys germanica* L.

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ABSTRACT

Observations on the life cycle and ecology of *Stachys germanica* L. (Labiatae) were made over a period of six years (seven flowering seasons) between June 1984 and October 1990, particular attention being paid to the role of predators. The hybridization of *S. germanica* in cultivation in private and botanic gardens is noted, and present and proposed conservation measures are discussed.

INTRODUCTION

Stachys germanica is widely distributed throughout western, central and southern Europe and is at the northern limit of its range in Britain; it extends southwards through the Mediterranean to North Africa, eastwards to southern central Russia, and into the Orient (Moore 1987). The earliest British record, published in Johnson's revised edition of Gerard's *Herball* (Gerard 1633), was by Leonard Buckner, a London apothecary, who found it in 1632 "wilde in Oxfordshire in the field ioyning Witney Parke [This deer park was laid out by the Bishop of Winchester in the 13th century and remained recognisable as a walled enclosure until late in the 17th century. The land is now farmed or built upon.] a mile from the Towne". Undisputed 18th, 19th and 20th century records are from N. Hants (v.c. 12), W. Kent (v.c. 16), S. Lincs (v.c. 53), Northants (v.c. 32) and Oxon (v.c. 23), but it is likely to have been more widespread in parts of southern Britain than these records suggest (Marren 1988). Most of the numerous localities recorded by Druce (1886, 1927) were from the oolitic limestone country of western Oxon, to which region the few remaining sites are now confined.

S. germanica is an endangered species, protected under the Wildlife and Countryside Act, 1981 (Perring & Farrell 1983).

POST 1983 DISTRIBUTION AND POPULATIONS

Since 1983 *S. germanica* has been recorded from five sites. Of these only two produced flowering plants in seven consecutive seasons (1984–1990), while at another site a single plant was seen only in 1987. In 1990, flowering plants were recorded at three sites. All are within the Oxfordshire distribution area shown by Marren (1988), and for convenience the site references he used are adopted here.

SITE A (ALSO KNOWN AS SITE X)

Fifty-six flowering stems were recorded at this new site, a green lane-bordered by arable fields, in June 1984 (Dunn, 1987a). Long-buried seed germinated after scrub clearance and hedge cutting between 11 February and 4 March 1983. (This date, recorded in the farm diary of the Estate concerned, is the correct one. A verbally given date, November/December 1982, was incorrect.) Although plants have flowered every year since then, largely because open ground conditions have been maintained, the colony has lost much of its vigour since 1985. The majority of plants have produced only one flowering stem instead of up to seven stems. They have also been smaller, on average. It was incorrectly stated (Marren 1988) that ". . . in 1986 the stems were picked before it [*S. germanica*] could set seed." The theft of these seed-bearing stems in late autumn 1986 has probably affected population numbers since then. There was no germination in the dry spring and summer of 1989. The 33 flowering stems recorded in 1990 were poor, and only five very small plants

TABLE 1. *STACHYS GERMANICA* (SITE A) COMPARISON BETWEEN NUMBER OF OVER WINTERING ROSETTES AND SUBSEQUENT NUMBER OF FLOWERING STEMS

o.r.	f.s.	o.r.	f.s.	o.r.	f.s.	o.r.	f.s.
1983/84	1984	1984/85	1985	1985/86	1986	1986/87	1987
—	56	20	60	116	56	133	116

o.r.	f.s.	o.r.	f.s.	o.r.	f.s.	o.r.
1987/88	1988	1988/89[1]	1989	1988/90	1990	1990/91
81	62	185	67	41	33	5

o.r. – overwintering rosettes
f.s. – flowering stems
[1] A mild winter in which 30–40% of overwintering rosettes, some very small, were partially or wholly destroyed by snails and/or slugs.

were found to have germinated after rain in September and early October ended a second year of drought.

Table 1 shows the fluctuations in numbers of overwintering rosettes and subsequent flowering stems between 1984 and 1990/91.

SITE B

For several decades *S. germanica* has appeared erratically at this site, an old bridleway bordered by hedges and bounded on either side by arable or other farm crops. Between the wars this lane was much wider and had no hedge on the southern side. A retired local farm worker recalled driving a horse and wagon along it and seeing a few villagers grazing house cows on the verges, which, until comparatively recently, were cut at regular intervals by council workmen.

In 1985, 43 fine flowering stems were recorded. No plants were seen in 1986 and 1987, by which time the site had become densely overgrown with *Prunus spinosa*, *Rosa* and *Rubus* spp., *Clematis vitalba*, coarse grasses, herbs and mosses.

In March 1988 the invading vegetation was cut down and burnt. The ground was then raked hard to clear it of dead plant litter and mosses, and to expose as much bare soil as possible. Buried seed germinated in late spring and by mid-June many seedlings and young plants of *S. germanica* had developed. That autumn c. 100 rosettes of various sizes were recorded. All survived the following mild winter, producing in the hot summer of 1989 – at least three weeks earlier than normally – c. 100 flowering stems. Further along the lane, where there had been simultaneous clearance work and burning but no raking, another 25 flowering stems were located among dense tall stands of *Artemisia vulgaris*, *Cirsium vulgare*, *Dipsacus fullonum* subsp. *sylvestris*, sprouts of *Crataegus monogyna*, *Cornus sanguinea*, *Euonymus europaeus*, *Prunus spinosa* and encroaching layers of *Clematis vitalba*.

By autumn 1989, c. 80 new rosettes were found at the main site, which measures approx. 7 × 1·5 m. In November a long section of the verge to the west was cleared by scrub-cutter. Raking and burning followed at the end of that year, and again in March 1990.

In the second hot summer of 1990, c. 130 flowering stems were recorded, all but seven of these being at the main site. By early August all but a few were found to have been completely stripped of their seeds by small mammals (see Predation).

Only ten small overwintering plants were found in the late autumn of 1990.

SITE C

This site has been fully described by Marren (1988). Table 2 shows how widely *S. germanica* populations have fluctuated between 1984 and 1990.

Of the 103 flowering stems borne by the 55 plants in 1989, 20 were found, on 1 August, to have been severed at or a little above ground level, and by mid-October this number had risen to 34. This site is difficult to search for overwintering rosettes on account of standing crops.

TABLE 2. CHANGES IN POPULATION SIZE OF *S. GERMANICA* AT SITE C, 1984–1990

Year	No. of plants	No. of flowering stems
1984	c. 100	no record
1985	1–40	no record
1986		
1987		
1988	17	22 (plus c. 18 pairs of fl. laterals)
1989	55	103 (plus 42 pairs of fl. laterals)
1990	1	1

SITE D

Although *S. germanica* has been known for many years at this site, numbers are declining. Only one flowering plant was recorded in 1987, none in 1988, and the single plant found in 1989 was growing in a small patch of bare earth at the bottom of this limestone grassland bank. No plants were seen in 1990.

TETRAD SP 4224

In 1987 one flowering stem was found in this tetrad, on the edge of a roadside ditch which had been cleaned out by workmen. No plants have appeared since.

THE GARDEN SITE

This is not a wild site but is included on account of its interest. As reported elsewhere (Dunn 1987b), *S. germanica* seeds were introduced accidentally into this west Oxfordshire garden with imported local topsoil more than twenty-five years ago. Although flowering plants were not noticed until the mid-1970s, they have appeared almost every year since then, no doubt because flower beds are continually disturbed by digging and weeding. The 1987 plants were exceptionally fine, bearing many pairs of flowering laterals on tall spikes. Apart from the one hybrid plant found and removed in the late summer of that year (see below), all the plants in this garden colony remain pure.

ECOLOGY

This section on the ecology of *S. germanica* is concerned with observations on the plant's life cycle, pollination, predation, and certain environmental factors.

THE LIFE CYCLE

S. germanica seeds ripen between July and early autumn, according to the season. Germination, which takes place almost exclusively around the parent plants, is erratic, commencing in late spring and, if conditions are favourable, continuing into early autumn. This accounts for the great variation in size of over-wintering rosettes, which at Site A in September 1987, for instance, measured between 2 × 1·5 cm and 24 × 19 cm in diameter. For three successive autumns at this site all new rosettes were marked and labelled, an experiment which showed that some overwintered twice before flowering. Out of an original group of 81, 24 did so in 1987/88 and again in 1988/89, the largest plant measuring 26 × 22 cm by the second autumn. A few were suspected of overwintering a third time, but as several labels were displaced by rabbits this could not be proved. Healthy, well-grown rosettes, which by late autumn have formed between four and ten medium-to-large leaves, usually overwinter successfully. Under-developed plants, or those measuring less than c. 2 cm in diameter tend to die, survive but fail to flower or produce only very small flowering stems in the following summer.

The silky-hairy appearance of the plants is most attractive in May and early June, when the plants are young. Growth is quite rapid during early summer, and by mid-June to mid-July mature plants can measure as much as 104 cm, or as little as 10 cm (Site A, 1985). Vigorous plants may produce up

to seven stems apiece, each stem bearing one or more pairs of laterals. Small, late-developing plants may not flower until September or early October.

Strictly speaking, *S. germanica* is a biennial, forming a rosette in the first year and dying after flowering in the second. Occasionally a robust plant will produce several shoots at the base of its stem, or stems, in late summer. This appears to be simply the result of the plant's vigour, in response to late summer/early autumn rains after drought, or after damage. Strong shoots will develop into fine flowering stems the following year, after which the plant dies. During the period of study, no such plant was seen to repeat this behaviour.

Dead plants will remain upright, or inclined, for many months. The seeds, four to each calyx, are not easily dislodged. Some have been found unshed after several months, a few even after a year. Deferred seed dispersal, erratic germination and delayed flowering are all strategies which extend the life cycle and assist the survival of the species.

POLLINATION

The following species of bumblebee were observed pollinating *S. germanica* flowers at Sites A and B: *Bombus hortorum* (L.), *B. lapidarius* (L.), *B. pascuorum* Scopoli, *B. pratorum* (L.) and *B. terrestris* (L.). It was noticed that the smallest of these, *B. pascuorum*, worked the flowers more thoroughly. Conspicuous numbers of the hoverfly *Episyrphus balteatus* (Degeer) visited Site A flowers in August 1987; other hoverflies seen here in 1989 were *Platycheirus albimanus* (F.) and *Syritta pipiens* (L.). The pollen beetle *Meligethes aeneus* (F.), which eats as well as distributes pollen, has occasionally been seen crawling in and out of the flowers.

PREDATION

Minimal to serious damage and destruction have been observed at all stages of growth in *S. germanica*, the principal predators being small mammals (mice and voles), snails and/or slugs, and the larvae of a micro-species of Tortrix moth. Rabbits have caused slight damage to plants at one site; and rabbits, hares or deer are suspected of causing more extensive damage at another.

Mice and voles

The most interesting, but most devastating, destruction occurred at Site B between 15 July and 7 August 1990. On the latter date all but a few of c. 130 stems (including laterals) were found stripped bare. Only the leaves remained. This proved to be the work of small mammals. The evidence lay in the shredded remains of *S. germanica* lying below and around the plants, two of these mats of plant material measuring 27 × 23 cm and 17 × 15 cm. A quantity of the material collected for closer examination contained, in addition to pieces of stem and small, whole leaves, a great quantity of calyces which had been detached from the whorls individually or in small sections. Each calyx had been split open from the base almost to the apex, or torn in half lengthwise. All were void of seeds, many of which would not have been ripe. Mixed in with these remains were seedless wings of the fruits of *Heracleum sphondylium* and broken, empty capsules of *Silene latifolia* and *S. vulgaris*, and, significantly, the droppings of mice and/or voles. Nearby, similarly shredded heads of *Centaurea scabiosa* littered the ground. Finally, the microscope revealed the presence of fragments of husks of *S. germanica* seeds.

To establish the identity of the rodents, three Longworth live-traps were set beside the plants on ten occasions, usually on alternate evenings, between 11 and 26 August. Fifteen long-tailed field or wood mice (*Apodemus sylvaticus* (L.)) and four bank voles (*Clethrionomys glareolus* Schr.) were captured, and on twelve occasions mice or voles entered the traps, ate some or all of the bait, deposited droppings, and escaped. Thirty-one captives and escapees are accounted for by the fact that on one occasion two long-tailed field mice were found in one trap. All captives were released at the edge of a wood 8 km away. One dead long-tailed field mouse was also found on the path beside the site.

It was learnt from discussions with a member of staff of the Department of Zoology, University of Oxford, that unusually high numbers of small mammals were captured in his study area in 1989 and 1990. These increases in population are attributed to two successive mild winters and fine summers (1988/89 and 1989/90) which no doubt reduced mortality rates and increased breeding levels. Other factors would have affected the numbers and behaviour of these small mammals at Site B. The crops (barley and rape) at either side of the bridleway were harvested by mid-July and the fields ploughed

shortly afterwards; hedgerow fruits and berries were unripe; and the only adjacent cover, once the fields were bare, would have been in these hedgerows and verges. Food and moisture were probably scarce. Out of a potential 100,000 or more seeds only a few hundred were saved.

Similar destruction, on a minor scale, was first observed at Site A early in October 1985. Here a Longworth live-trap set close to a hole near two small de-headed *S. germanica* plants captured a long-tailed field mouse. Close by, in June, seeds of *Viola hirta* L. were found to have been similarly raided, the cream-coloured seed-coats lying in little heaps around the plants.

Small mammals tunnelling through the soil have disturbed seedlings and young plants, detaching their roots and raising them up. A group of 30 seedlings at Site B (1989) failed to survive such disturbance; others, pushed down into firm soil, were saved.

Other mammals

At Site A rabbits have occasionally forced their way into a fenced-off area, disturbing seedlings and young plants and burying rosettes under scuffed-up soil.

In May 1990, at Site B, the tops of four or five young plants were found lying on the ground below. Rabbits were almost certainly responsible, and further damage was prevented by placing *Prunus spinosa* trimmings around the plants and into the runs between the hedge and the site.

At Site C, in 1989, 34 flowering stems were found to have been severed from about a dozen plants, some of which had borne up to five stems each. None of the missing stems was traced, except on one occasion, when two, freshly broken off, were found lying beside a plant. Stems of such plants growing among second-year kale had been broken off several cm from ground level, while others in open ground had been severed at the base, as though bitten off. This site is frequented by rabbits, whose numbers have greatly increased on this farm in recent years (c. 500 were killed after harvest in 1990). Hares are seen occasionally, and deer are known to pass through the site. Deer droppings – much less plentiful than those of rabbits – were of fallow or muntjac.

Snails and/or slugs

At Site A, in the autumn of 1988, 185 rosettes of various sizes, some very small, were individually numbered (with labels), measured and recorded. Only 67 survived to flower the following summer. Of the remaining 118, 75 were lost and 43 either failed to grow beyond the vegetative stage or developed into small, non-flowering plants. It was evident that between 30 and 40 per cent had been partially or wholly eaten away by slugs and/or snails during the mild winter. Live snails collected at the site included *Candidula gigaxii* (Pfeiffer), *Cepaea hortensis* (Müller), *Monacha cantiana* (Montagu), *Pomatias elegans* (Müller), *Trichia striolata* (Pfeiffer) and *Vitrina pellucida* (Müller); empty shells were of *Cernuella virgata* (da Costa), *Cochlodina laminata* (Montagu) and *Trichia hispida* (L.).

One unfortunate plant which first overwintered in 1987/88 failed to develop in 1988 and in late August of that year had most of its leaves shorn off by a verge-cutting machine. It subsequently formed four large new leaves, only to have these eaten away by snails or slugs during the following winter (a live specimen of *Vitrina pellucida* was found on the underside of one of its leaves). By mid-May 1989 only fragments of the leaves and midribs remained, and a few weeks later the plant died.

Tortrix moth larvae

At Site A, in May 1985, the leaves and developing shoots of a few *S. germanica* plants were damaged by a small, dingy-brown caterpillar, only one of which was found on each plant. All were destroyed except one, which was removed and allowed to pupate in captivity. The emergent imago was identified as *Cnephasia interjectana* (Haw.), a microspecies of leaf-rolling Tortrix moth. While the effect on leaves was not serious, damage to the growing shoots was severe, resulting in stunted spikes and the consequent loss of many whorls of flowers and seeds.

Damage by this Tortrix moth has been noted in up to seven plants at Site A each year of the study, but has not been observed at other sites.

SOME ENVIRONMENTAL INFLUENCES

The oolitic limestone soil of these sites varies from a light, almost sandy cornbrash to medium, stony loam or marl and supports a varied and sometimes rich flora. Where this soil combines with an open, sunny habitat *S. germanica* thrives best; whereas in situations which are overshadowed, by

hedgerow trees for example, it tends to grow less vigorously and flowers later. It is a species which competes poorly with other plants, soon becoming overwhelmed by grasses, perennial herbs and shrubs, especially where these form a close sward or scrub conditions. Bare ground is essential for the germination of its seeds and the formation of overwintering rosettes. Where the soil is kept open deliberately, or is disturbed in the course of crop cultivation, it maintains its presence more successfully, and more regularly. Conversely, at Site A, for example, in places where single or small groups of plants first appeared in 1984 and it has not been possible to preserve open ground, *S. germanica* has not reappeared.

The composition and number of associated plants varies at different sites. In late May 1988, for instance, during clearance work by hand of invading vegetation in an area at Site A measuring approx. 5 × 2 m, no less than 46 other species were found to be growing in close proximity to plants of *S. germanica*. Among these were *Arrhenatherum elatius*, *Bromus erectus*, *Cirsium vulgare*, *Clinopodium vulgare*, *Centaurea nigra*, *C. scabiosa*, *Galium mollugo*, *G. verum*, *Mercurialis perennis*, *Plantago lanceolata*, *Poa pratensis*, *Primula veris*, *Ranunculus repens*, *Silene latifolia*, *Stachys sylvatica*, *Tamus communis*, *Torilis japonica*, *Viola hirta* and *V. riviniana*. Also here were sprouting stumps of *Acer campestre*, *Clematis vitalba*, *Crataegus monogyna*, *Prunus spinosa*, *Sorbus torminalis* and *Viburnum lantana*. In addition, the following mosses covered parts of the soil: *Barbula unguiculata* Hedw., *Bryum* sp., *Eurhynchium praelongum* (Hedw.) Hook., *Fissidens taxifolius* Hedw., *Phascum cuspidatum* Hedw. and *Pseudoscleropodium purum* (Hedw.) Fleisch.

Extremes of weather can affect *S. germanica* adversely. Very small plants may be lifted from the soil in severe frosts; leaves, seedlings or small plants may decaye in prolonged wet weather in autumn and winter; and summer drought can cause stress, inhibit growth and prevent germination. A summary of weather at Oxford between 1984 and 1990, extracted from records compiled by the Radcliffe Meteorological Station, School of Geography, University of Oxford, is shown in Table 3.

There is also the human factor. In 1987 and 1988, seeded plants at Site A, an S.S.S.I., were torn to pieces and scattered by a hedge- and verge-cutting machine following a breakdown in communications and instructions on the part of the Estate concerned. Flowering stems have occasionally been picked by unknown persons, and, as mentioned previously, seed-bearing stems have been stolen.

HYBRIDIZATION

In 1987, suspected hybridization between *S. germanica* and *S. byzantina* C. Koch (syn. *S. lanata* Jacq.) occurred at the Garden Site. The hybrid plant, which grew beside a stand of pure *S. germanica* in a flower border, was different in several respects: the stem and leaves were densely felted rather than silky-hairy; the leaves were of a slightly different shape, and entire instead of crenate; and at the base of the stem were several fresh shoots and leaves. The plant was removed, potted, and taken away. In 1988 it produced three flowering stems and fresh basal shoots and leaves. At the request of Dr S. R. J. Woodell, Department of Plant Sciences, University of Oxford, a few pollen-bearing flowers were collected from this plant and also from *S. byzantina* and *S. germanica*. The results of the pollen stain tests (Table 4) confirm that the plant was of hybrid origin.

The hybrid plant produced one flowering stem in 1989 and one in 1990. Each year it has formed basal shoots and leaves, indicating a perennial rather than a biennial habit.

About 120 seeds were extracted from the original hybrid, 55 of which were sown in a seed tray the following spring. The largest twelve of the 25 young plants which germinated were potted on and by October 1988 were well developed. During the hot summer of 1989, in unavoidable circumstances, ten perished through lack of water. One of the remaining two produced a stunted stem bearing only a few flowers, and the other failed to develop beyond the vegetative stage. By autumn both had recovered, put on fresh growth and overwintered successfully in 1989/90. In the summer of 1990 one bore four short flowering stems, and, by autumn had produced a dense mass of basal leaves; the other bore one tall flowering stem and no basal shoots or leaves. All appeared to carry viable seed.

In 1987 and 1988 visits were made to University botanic gardens at Bristol, Cambridge and Oxford to examine *S. germanica* in cultivation in systematic beds. It was interesting to find that in all cases the stands labelled '*Stachys germanica*' contained plants unlike the wild species. Some were strikingly different, their appearance suggesting that *S. alpina* and *S. byzantina* were involved in the

TABLE 3. WEATHER SUMMARY AT OXFORD: 1984–1990
(by permission of the Radcliffe Meteorological Station, School of Geography, University of Oxford)

Year	Mean air temp. (°C)	Rainfall (mm)	Bright sunshine (hours)	Ground frost (days)	Snow lying (days)	Notes
1984	10·2	608·5	1574·2	113	3	1983/84 winter slightly warmer and wetter than average. Unsettled spring, with frequent ground frosts; driest and sunniest April since 1912. Notably warm, dry, sunny summer, with below average rainfall. Mild wet autumn/early winter.
1985	9·2	662·0	1483·2	114	27	Jan.–Mar. cold, with frequent snow and hard frosts. Changeable spring; heaviest daily rainfall in May on record. June–Aug. wettest since 1971. Dry, cool autumn. Dec. mild and wet with some severe frosts.
1986	9·2	704·3	1617·8	116	14	Year dominated by westerly airstreams. Feb. extremely cold. Spring cold and wet; April coldest since 1881. Cooler and wetter summer than average. Dry, cold autumn. Mild early winter.
1987	9·4	592·6	1372·6	102	16	Some unusually cold weather at beginning and end of year. Changeable spring. Average summer, with less sunshine. Wettest Oct. since 1960.
1988	9·9	571·1	1401·6	104	6	Beginning and end of year remarkably mild. Very wet Jan. (100 mm). Unsettled spring with less than average sunshine. Cool, rather wet summer. Last five months bright and very dry.
1989	11·1	598·1	1868·1	94	1	Second consecutive mild winter (1988/89). One of the warmest and sunniest years of the century. (Nationally the warmest year since 1659.) Rainfall well below average. Dec. wettest month.
1990	11·1	473·0	1875·7	96	2	Third successive mild winter (1989/90); warmest since 1815, wettest since 1767. Spring warm, sunny and dry. Hot, dry summer (max. temp. 35·1°C on 3 Aug. highest ever recorded). Warm autumn with below average rainfall.

LONG TERM MEAN READINGS:

Air temperature (°C) (1815–1980):	9·5
Rainfall (mm) (1767–1980):	642·5
Bright sunshine (days) (1881–1980):	approx. 1480·0
Ground frost (days) (109 years):	103·7
Snow lying (days) (64 years):	11·4

TABLE 4. NUMBERS OF POLLEN GRAINS IN SAMPLES OF THREE *STACHYS* TAXA

Species	Well stained	Collapsed or non-stained
Stachys germanica	265	22
	213	25
	283	66
	224	22
S. byzantina	225	19
	215	23
	224	27
	184	41
hybrid	196	230
	170	126
	164	100
	148	166

hybridization which had clearly taken place; both these related species grew with *S. germanica* in all the beds, together with *S. affinis* Bunge (China, Japan), *S. grandiflora* (Willd.) Benth. (Caucasus) and *S. officinalis* at Cambridge, and *S. officinalis* at Oxford.

Also of interest were specimens of *S. germanica* seen in three private gardens in Oxon, all plants having been raised from wild seed of uncertain provenance. In one case, where the introduction had taken place about twenty-five years ago, the plants were no longer pure, their appearance suggesting hybridization with *S. byzantina*, which grew in another part of the garden. Seed collected from these plants by the owner and sent to a seed bank were later destroyed as impure. In the second case, where plants had been established for about nine years, several of many very fine stems exhibited features, including a semi-prostrate habit, which were uncharacteristic of the true species and more typical of *S. byzantina*. In the third case, where seed had been introduced only four years previously, the plants were pure.

In view of the ease with which *S. germanica* hybridizes it was strongly recommended that in the event of reintroductions into the wild only seed gathered directly from wild stock should be used.

Although hybridization of *S. germanica* and *S. palustris* L. has been reported from France, Germany and Hungary, and with *S. sylvatica* L. from Hungary (Stace 1975), there is no record of such hybridization in Britain. However, a watch is being kept at one site where *S. germanica* and *S. sylvatica* grow in close proximity.

CONSERVATION AND RECOVERY PLAN

In September 1989 the B.S.B.I. Rare Plants Translocation Panel agreed that *S. germanica* plants could be raised from seed and reinstated, at the rosette stage, in the wild, as part of a recovery programme. About 100 seeds were collected from each of three sites, labelled and then refrigerated. In the following spring/early summer the seeds were sown in three separate containers, the subsequent germination rate being 25, 34 and 50 per cent. The young plants were later transferred to individual pots, and after late September/early October rains ended the long drought of 1990, a total of 112 leafy rosettes were planted at the parent sites. These reintroductions will help to strengthen populations, assist continuity of flowering, and increase seed banks in the soil.

Past and present efforts to warden sites, protect plants and initiate site clearance could not have been sustained without the co-operation of a few local botanists and, in 1988 and 1989, several members of staff of the N.C.C. The aims of the immediate future for these three sites are to continue the management work and maintain the interest and support of site owners. In the long term, it is recommended that a few old sites which are still suitable for supporting populations should be opened up, and appropriately managed, within the next five years. This would help to make the future of *S. germanica* more secure and possibly change its status from threatened to rare. It would be one example of a successful recovery plan. However, if these measures fail, consideration should

be given to the creation of one or two carefully selected sites in places where the species is known to be native.

In the meantime, these recent observations have shown that it is not only land management practices that continue to threaten the survival of *S. germanica* in Britain, but also climatic and animal factors.

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REFERENCES

Druce, G. C. (1886). *The flora of Oxfordshire*. Oxford.
Druce, G. C. (1927). *The flora of Oxfordshire*, 2nd ed. Oxford.
Dunn, A. J. (1987a). Observations on *Stachys germanica* L. at a new site in Oxfordshire. *Watsonia* **16**: 430–431.
Dunn, A. J. (1987b). *Stachys germanica* L. in an Oxfordshire garden. *B.S.B.I. News* **47**: 29.
Gerard, J. (1633). *The herball or generall historie of plantes*. Revised by T. Johnson. London.
Marren, P. M. (1988). The past and present distribution of *Stachys germanica* L. in Britain. *Watsonia* **17**: 59–68.
Moore, D. M. (1987). Labiatae, in Clapham, A. R., Tutin, T. G. & Moore, D. M. *Flora of the British Isles*, 3rd ed. Cambridge.
Perring, F. H. & Farrell, L. (1983). *British red data books*: 1. *Vascular plants*, 2nd ed. Lincoln.
Stace, C. A. (1975). *Hybridization and the flora of the British Isles*. London.

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The distribution of hybrid Marram Grass, × *Calammophila baltica* (Flügge) Brand, in the British Isles

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ABSTRACT

The geographical distribution of × *Calammophila baltica* (Flügge) Brand (= × *Ammocalamagrostis baltica* (Schrad.) P. Fourn.), in the British Isles is described, and aspects of its ecological distribution and limits are discussed, especially in relation to *Ammophila arenaria* (L.) Link.

INTRODUCTION

The hybrid Marram Grass, × *Calammophila baltica* (Flügge) Brand (= × *Ammocalamagrostis baltica* (Schrad.) P. Fourn.), is a naturally occurring intergeneric hybrid, derived from *Ammophila arenaria* (L.) Link and *Calamagrostis epigejos* (L.) Roth (Westergaard 1943). It is rare in Britain, being reported only from the East Anglian coast and around Holy Island, Northumberland. It is found on sand dunes coexisting with one of its progenitor species, *A. arenaria*.

On the coasts of mainland Europe the hybrid is found in three varieties depending on the relative contributions of the genomes of the progenitor species (Westergaard 1943). The British populations have all been identified as belonging to × *C. baltica* var. *subarenaria* (Hubbard 1975), the variety to which the *A. arenaria* genome makes the greatest contribution.

Ammophila arenaria, Marram Grass, is found on all coastal dune systems in Europe and North Africa, from the Mediterranean to about 62° N. (Tutin 1980), including the whole of the British Isles. It is occasionally found inland and on the sandy shores of lakes (Westhoff *et al.* 1970). Doing (1985) describes *A. arenaria* as occurring from Norway to western Spain, and *A. arenaria* var. *arundinacea* on Mediterranean coasts. It has also been transplanted to the Pacific coast of the North American continent (Pohl 1968).

In the British Isles Marram is found wherever a suitable habitat occurs, usually in coastal sand dune systems. It is common on the coasts of both East Anglia and Northumberland. Marram is a very important component of the sand dune successional system, and largely controls the rate of dune growth and sand stabilisation. As such it is widely planted in order to protect beaches threatened by erosion.

Calamagrostis epigejos, Bush Grass, is found in damp and disturbed areas throughout Europe, though it is less common in the south-west. It may be found on sand dunes around Baltic and northern European coasts (Westergaard 1943; Doing 1985). In Britain this species appears to be more rare than in former years, which may be a reflection of the changes in agricultural practices over the past 100 years. It is less common than it was in East Anglia, and is now absent in Cheviot (v.c. 68).

× *Calammophila baltica*, Hybrid Marram, appears to be confined to north-western coasts of Europe, from Dunkirk in the south (van den Berghen 1964) to somewhat south of 60° N. (Hultén 1971). It is common in parts of southern Sweden and Norway, in Poland, Russia, Denmark and the Netherlands (Doing 1985), where, together with marram grass, it is widely planted for sand dune

conservation. Indeed in many places, because of its apparent vigour, it is preferred over marram for this use.

The history of the origin and spread of Hybrid Marram in Britain has been complicated by the failure of early authors to recognise it as a separate taxon. The earliest reliable dates appear to be 1871 in Northumberland (Richardson 1872; Trimen 1872) and 1885 for East Anglia (Ellis 1960). At the latter site, however, it is possible that a hybrid individual was found over 80 years earlier (Ellis 1960).

When the present study began, Hybrid Marram was thought to occur in Northumberland, on Holy Island and Ross Links, and at Alnmouth (Swan, pers. comm.); and in East Anglia, at Holme-next-the-Sea on the north coast, and from Waxham to Sizewell on the east (Ellis 1960). Much of the East Anglian distribution has been altered by the transplanting of marram from Winterton for dune rebuilding works, particularly after the tidal surge of 1953 (Ellis 1960; Taylor & Marsden 1983). It seems unlikely that the hybrid was knowingly chosen for transplanting, but its larger size and general vigour would encourage the men collecting to take it, rather than *A. arenaria*, when they were growing side by side.

There is a record for the hybrid on Handa Island, off the Sutherland coast, one of the few places in Britain where *A. arenaria* and *C. epigejos* occur together (Heslop-Harrison & Heslop-Harrison 1938). This has never been confirmed despite several intensive searches which have been made for it over the last 50 years. It is still reported as being present (though rare) on the island in the most recent Flora of Sutherland (Kenworthy 1979).

Hybrid Marram is also known to have been accidentally transplanted, as a consequence of taking marram for dune conservation purposes from Winterton, to Milford on Sea, Hampshire. It is known that marram has been exported to many parts of the country (and, indeed, the world) (E. A. Ellis, pers. comm.) from Winterton, and it seemed highly likely that other such populations may exist.

In Britain, Hybrid Marram is generally described as a foredune plant (Robertson 1955) or even a coloniser of bare beach sand (Ellis 1960).

METHODS

DISTRIBUTION

All the sites where × *C. baltica* had been recorded (records taken from Perring & Sell (1978), Swan, pers. comm., and E. A. Ellis (1960 & pers. comm.)) were visited between August 1979 and August 1982. Adjacent beaches, identified as sandy on large scale Ordnance Survey maps were also searched. A similar survey was carried out in East Anglia and Northumberland in 1987. Handa Island had also been visited in 1978, prior to the commencement of this study.

The beaches were reached from suitable points inland, and approximately one hour spent on each area searched. The results were recorded on a visual estimate of abundance; one record was made for each area surveyed.

ECOLOGICAL LIMITS

In order to determine the ecological limits of × *C. baltica* a survey was carried out in both East Anglia and Northumberland. Ten 2 m × 2 m quadrats were taken at random within 50 m × 50 m areas selected to represent each successional stage of the dune systems. Ten areas were surveyed in East Anglia, all in the Winterton/Horsey dunes, and four in Northumberland, at Ross Links and Budle Bay; this represents the greater heterogeneity of the East Anglian dune system. A number of variables were recorded, including the percentage cover of each species, the length of the longest (vegetative) tiller, and the number of flowering tillers.

The cover abundance of × *C. baltica* and *A. arenaria* were compared for evidence of the apparent coexistence of the two species, and the performance data were examined for competitive effects between them. The performance data of × *C. baltica* only were examined for evidence of differential distribution of the species across the different dune stages.

RESULTS AND DISCUSSION

THE NORTHUMBERLAND POPULATIONS

The North Northumberland coastline was searched from Berwick upon Tweed, in the north, to

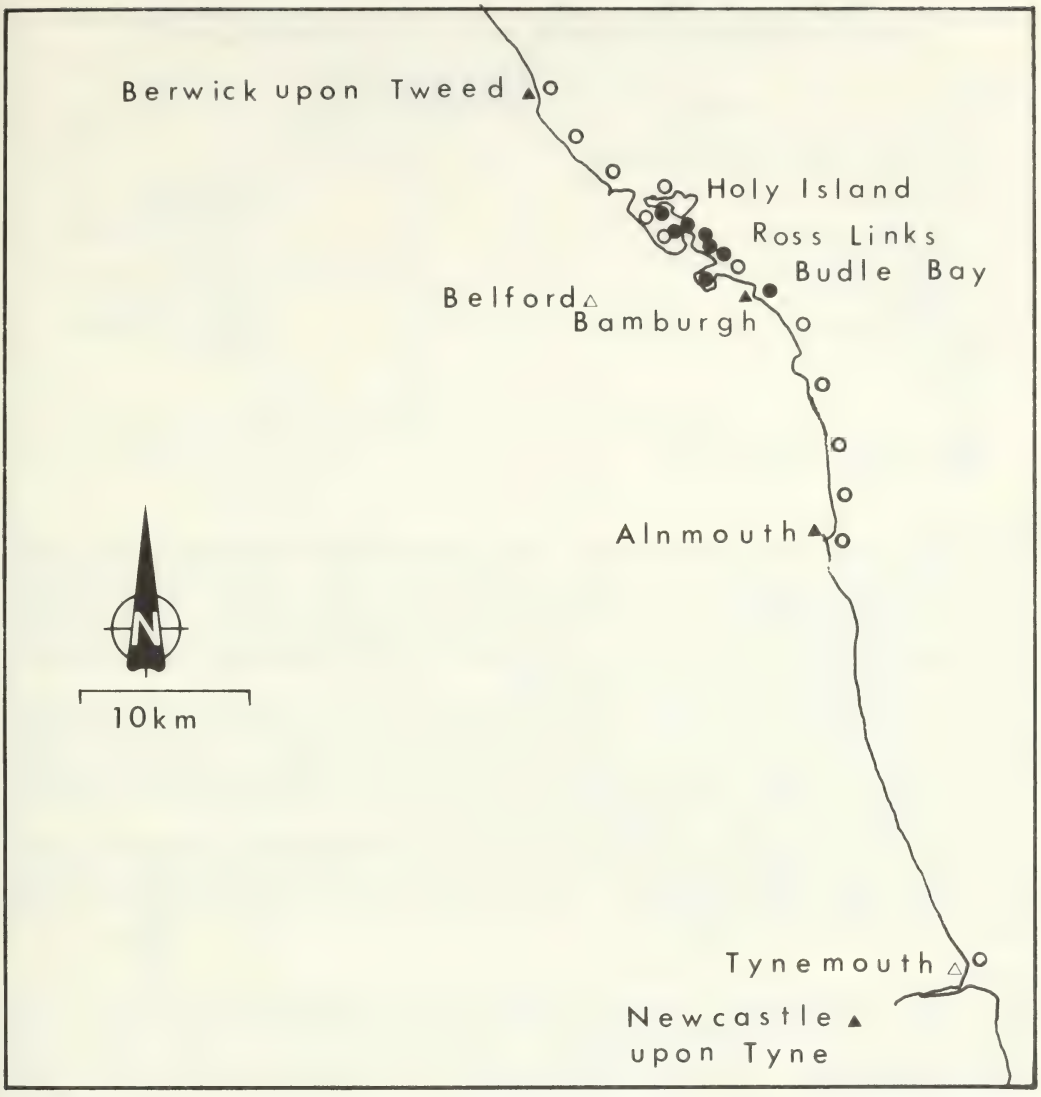

FIGURE 1. × *C. baltica*: Northumberland coast distribution. ● presence, ○ absence of × *C. baltica*. ▲, △ Towns

south of Alnmouth (v.c. 68). Fig. 1 shows the distribution, and Table 1 the estimates of abundance and O.S. grid references of the populations found.

Holy Island

There was no sign of the hybrid on the partially rocky coast between Berwick and the salt marsh of Holy Island Sands.

On Holy Island there is one small population beside the road leading to the causeway, which despite its size, (and attraction for dried flower arrangers!) appeared to be flourishing at the time of the first survey, but diminishing, probably due to the effects of competition, by 1987. A second population, on the north side of the Island, around GR 46/120437, seen in 1980 by the warden, Peter Corkhill (pers. comm.), two years after a major fire, could not be located.

TABLE 1. DISTRIBUTION: VISUAL ESTIMATES OF ABUNDANCE AND O.S. GRID REFERENCES FOR NORTHUMBERLAND × *C. BALTICA* POPULATIONS

Place	Estimate of abundance	Grid reference
Cheviot, v.c. 68		
Berwick upon Tweed to Holy Island Sands	0	—
Holy Island	2	46/118.433
Ross, North	3	46/126.382–132.393
Ross, Old Law	4	46/133.393–133.400
Ross Point	3	46/133.392
Ross, East	4	46/133.391–152.367
Ross, South	3	46/150.365–141.359
Budle Bay, South	4	46/154.354–162.360
Bamburgh	2	46/180.354
to		
Alnmouth	0	—

Scale 0 – absent; 1 – occasional tillers; 2 – occasional tussocks; 3 – common, but not dominant; 4 – common, occasionally dominant

Ross Links

On Ross Links, × *C. baltica* is very abundant, comprising up to 50% of the marram in some parts. The northern edge of the peninsula consists of a stable sand 'cliff', apparently protected from erosion by the salt marsh lying below it, with a narrow strip of dune vegetation, usually less than 10 m wide, separating the edge of the cliff from the reseeded pasture beside it (Culwick 1977). Hybrid Marram is found in small patches from the eastern end of a concrete sea wall (first built c. 1863, D. A. O'Connor, pers. comm.) to Ross Point.

The hybrid is abundant on the Point, and on the Old Law, which in common with the rest of the eastern shore appears to be undergoing massive sand accretion, building up a wide area of low dune, dominated mainly by *Leymus arenarius* (L.) Hochst. It is very abundant in places on this side, particularly on the still mobile sand behind the *L. arenarius*, but also in the fixed dune to the rear of it and in the edges of the reseeded pasture which adjoin this.

The south side of the peninsula, adjoining Budle Bay, resembles the north in topography, but the slope from the Links to the sea is not quite so steep, the transition from sand to mud not so sharp, and the fringing salt marsh is narrower. × *C. baltica* is not as abundant here as elsewhere on the peninsula, but still fairly common.

Budle Bay

On the south side of Budle Bay, in a sandy embayment, which is still accreting, × *C. baltica* is very common. To the west there are low, mobile, *L. arenarius* dominated dunes, on which it is rare, but moving east, as the beach widens, it becomes very abundant. Further on the land rises, with a steep sandy slope leading down to the sea and a rocky foreshore, and the hybrid thins out again. It is likely that this population is derived from Ross Links, from where 'marram' had been transplanted some years previously in a successful attempt to build up the dune system (D. A. O'Connor, pers. comm.).

Bamburgh

The beach at Bamburgh, north of the castle, consists of apparently very old, much eroded dunes, dissected by tracks and topped by marram. One very small, fairly depauperate stand of × *C. baltica* was found there in 1979, not seen in 1980 but relocated in 1987.

Bamburgh to Alnmouth

No × *C. baltica* was seen at any of the beaches between Bamburgh and Alnmouth, nor at Alnmouth, despite extensive searching on both sides of the river mouth.

THE EAST ANGLIAN POPULATIONS

The East Anglian coast was searched from Holme-next-the-Sea, in the north, as far south as

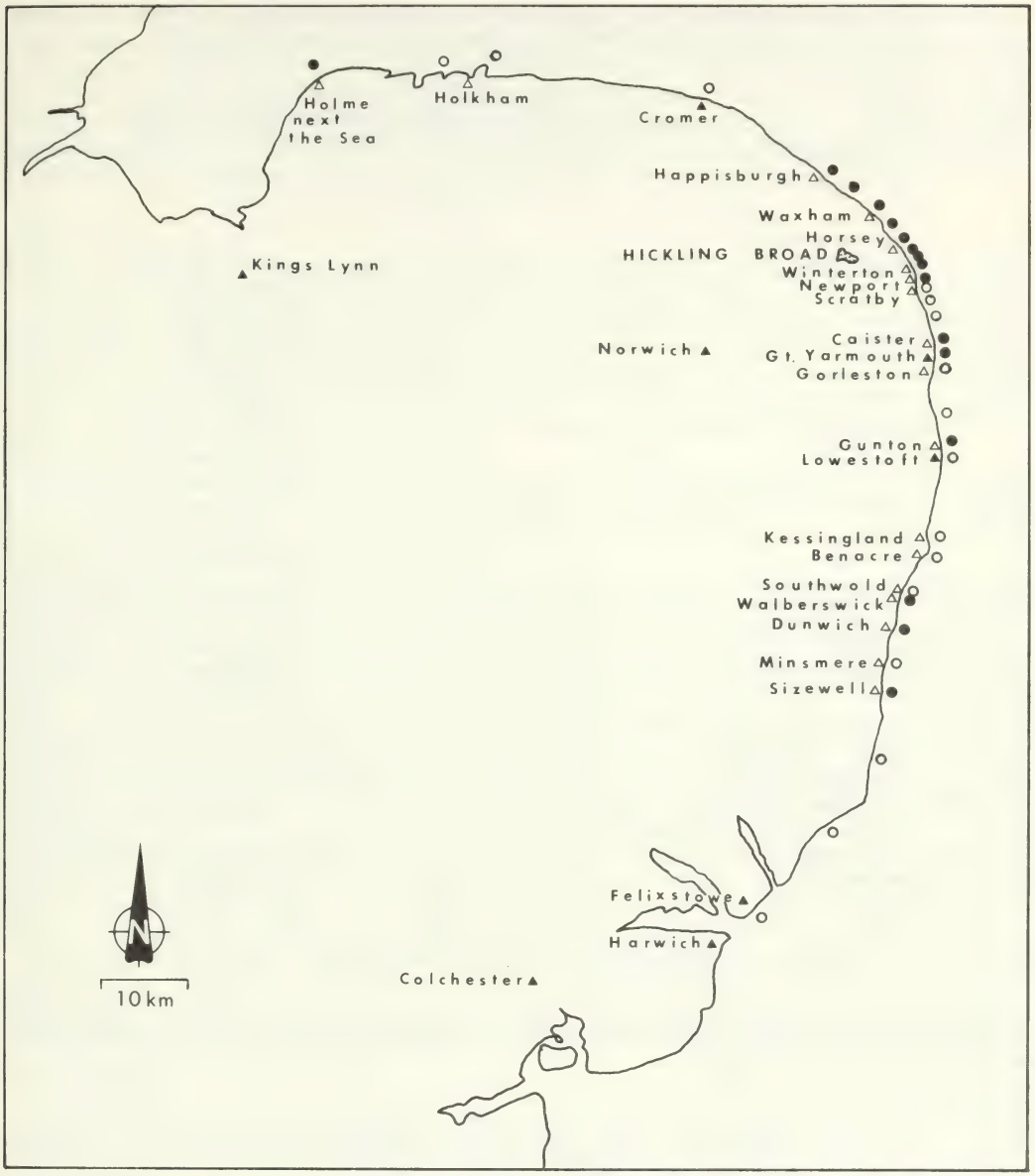

FIGURE 2. × *C. baltica*: East Anglian coast distribution. ● presence, ○ absence of × *C. baltica*. ▲, △ Towns

Felixstowe (the coasts of v.cc. 28, 27 & 25). Fig. 2 shows the distribution, and Table 2 the estimates of abundance and O.S. grid references, of the populations found.

Holme-next-the-Sea

The beach at Holme consists of a single dune ridge (artificial), protected by a very wide sandy beach, and backed by a long narrow (artificial) mere. On the seaward side of the dune the vegetation is fairly sparse, with large amounts of bare sand, though the system looks very stable. On the landward side the vegetation is much thicker. Hybrid Marram is very common on both sides of the ridge, from

TABLE 2. DISTRIBUTION: VISUAL ESTIMATES OF ABUNDANCE AND O.S. GRID REFERENCES FOR EAST ANGLIAN × *C. BALTICA* POPULATIONS

Place	Estimate of abundance	Grid reference
W. Norfolk, v.c. 28		
Holme-next-the-Sea	2	53/700.445
to	0	—
E. Norfolk, v.c. 27		
Happisburgh	1	63/382.312
	2	63/401.297
	2	63/405.294
Eccles	2	63/412.289
	2	63/421.281
	2	63/421.284
	3	63/429.275
Sea Palling	2	63/430.275
Waxham	3	63/442.265
	2	63/445.261
Horsey Gap	4	63/465.243
to		
Winterton	4	63/495.195
to		
N. Hemsby	4	63/506.173
Hemsby to Caister	0	—
Caister	2	63/524.136
Yarmouth, N. Denes	2	63/533.100
	2	63/533.095
Yarmouth, S. Denes (1979)	1	63/532.038
Gorleston to Gunton	0	—
E. Suffolk, v.c. 25		
Lowestoft, N. Roads	1	62/551.955
Lowestoft Denes to Southwold	0	—
Walberswick	1	62/503.747
Dunwich	1	62/479.706
Sizewell	1	62/477.632
Aldeburgh to Felixstowe	0	—

(For estimate of abundance see Table 1)

the base on the seaward side to about halfway down the landward side, from here to the edge of the mere it is very much less frequent.

Holme to Happisburgh

No × *C. baltica* was found on any of the beaches inspected between Holme and Happisburgh, including the beaches of Holkham, Sheringham, Bacton, Keswick and Walcott.

At Holkham *A. arenaria* and *C. epigejos* grown within 70 m of each other. As at Holme, there is a single dune ridge, protected to the seaward side by a wide beach and a recurving spit, the crest and rear of the dune have been planted with pine, and behind it is a wide dyke, draining the fields inland. *C. epigejos* grows in a wide sward, on a sandy peat soil, between the dyke and a track running at the base of the dune. There are also two small outcrops on the other side of the track. The *A. arenaria* is found on the crest of the seaward side of the dune, again with isolated patches towards the top of the landward side.

Happisburgh to Horsey Gap

The northernmost limit of × *C. baltica* on the east East Anglian coast appears to be at Happisburgh, where it occurs in very small, isolated patches in the marram above the wooden sea defences there. From here to Horsey it is not uncommon, though its distribution is patchy. The beach along this

stretch of coast is under constant threat of erosion, and a concrete sea wall, reaching from Happisburgh to north Winterton, was constructed in 1959. During construction all the vegetation was cleared from the site, which was later replanted, behind the wall, with marram from Winterton (H. Dolman, N.C.C., pers. comm.). For the most part, the beach is now accreting, and in many places the wall is obscured by low mobile dunes which have built up against it. × *C. baltica* is equally frequent on the older, stabilised dune behind the wall, where it was planted, and on the new dunes, when it has been able to spread from an existing population.

Horsey and Winterton

This is the area regarded by Ellis (1960) as the centre of the East Anglian Hybrid Marram populations. At Horsey Gap the hybrid is very common throughout the dune system. The dunes here are quite wide, though the sea wall is still visible in some places to the north, the beach itself is quite narrow. Behind the dunes, to the north of the track leading to the Gap (GR 63/463.241), × *C. baltica* is well established on sandy tussocks overlying damp, marshy ground, and it was also common in a meadow (reseeded?) south of the track. *A. arenaria* was depauperate and uncommon in both these sites. Further south, the hybrid grows particularly strongly against the walls of a World War 2 lookout post (GR 63/468.238).

At Horsey Warren the dune ridge is very wide, and the state of the vegetation cover indicates that it is composed of two dunes widely differing in age, the vegetation cover on the older one dating prior to the building of the sea wall, while the younger, seaward, one has since accreted against it. × *C. baltica* is very common on both systems.

Continuing southward the dune system becomes wider and more complex, the high, undulating ridges being backed by a narrow area of sandy heath. In the heath the marram is rare, and depauperate, and no hybrid could be identified here, but it is very common, in places dominating, throughout the sand dunes. In one area, a large blowout, at the end of the existing sea wall, the hybrid can be seen defining a now disused track (GR 63/494.270), last thought to have been used in 1975 (J. R. V. Ash, pers. comm.). In the same blowout, there are two areas which have been planted with marram, one probably more than 23 years ago (exact date not recorded), and one in 1979. In the older one, the hybrid is hard to find, but close examination reveals that it is not uncommon. In the newer area, it can be easily picked out by the greater height, width and spread of the clumps.

On the most recent visit to this area it was apparent that work had been undertaken in order to conserve the Natterjack Toad (*Bufo calamita*). Several scrapes had been established in the north of the dune heath, and *C. epigejos* was found nearby. This had not been noted before, though several of the natural depressions had been searched on previous visits.

Closer to the village, the beach is served by a large car park, much used by tourists in the summer months, and consequently the marram vegetation is being killed, and the underlying sand eroding. The hybrid is still very common, especially around the base of an N.C.C. notice (GR 63/494.202), round the edges of some huts at the north end of the car park, and around the car park generally (to the north of GR 63/498.197).

To the south of the road to the car park, from the inland to the beach, is a raised beach, a deep heath filled 'dyke', and then a low lying sandy slack, slowly rising to the present dune system. Again the hybrid is relatively common throughout the system, from the slack to the beach.

On Hickling Broad, some 6 km inland from Horsey, there is a small colony of *C. epigejos* (GR 63/428.212), previously thought to have been the closest occurrence of this species to the × *C. baltica* populations at Winterton (Ellis 1965).

Winterton to Yarmouth

× *C. baltica* is fairly common where there are suitable beaches in this stretch of coastline, it was not, however, found at Hemsby, Newport, Scratby or California, where there were sand cliffs, with a stable turf on top, and mobile beach sand below. At Caister it grows in large clumps on low lying open sand, well back from the tideline. On Yarmouth North Denes, a recently accreted area (Clayton *et al.* 1983), are low dune hillocks, with well established vegetation, separated by wide areas of sand. × *C. baltica* was present on several of these, as well as in the stabilising vegetation at the back of the Denes. Further towards Yarmouth, the beach becomes more 'developed' and no

TABLE 3. CORRELATION MATRIX OF THE VARIATION IN % COVER OF × *C. BALTICA* AND *A. ARENARIA* WITHIN THE QUADRATS

	No. of quadrats								
% cover *A. arenaria*									
70		1							
60					1				
50	1	1			1				
40		1							
30	2	3	1	1	1				
20	14	15	9	3	2			1	
10	6	48	20	1	3	1	2	1	2
0	3	2	2	2					
% cover × *C. baltica*	0	10	20	30	40	50	60	70	80

marram exists. In 1979, there was one population of the hybrid at the south end of the South Denes, but subsequently this site was found to be under a thick layer of concrete.

South Yarmouth to Southwold

There was no Hybrid Marram on any of these beaches, with the exception of a few small patches north of Lowestoft. Between Yarmouth and Corton the beach is backed by cliffs, with very little dune and in most other places the dunes had been regraded into promenades and lawns. At Kessingland, where there is a very wide sandy beach, though with very little dune system behind, it was not found despite several extensive searches.

Walberswick to Felixstowe

Patches of the hybrid were fairly common on the northern beach at Walberswick, especially inland of a low sea wall. On the southern beach, with a single, man-made dune ridge it was less common. Small populations were also found at Dunwich and Sizewell, but none anywhere further south. The Sizewell population has not, apparently, been lost to the new power station development on this beach.

OTHER AREAS

Handa

Handa Island is a small island (2·5 × 2 km) lying off the Sutherland coast, just north of Scourie (v.c. 108). On the south-west corner of this island, at the base of the cliffs, there are a series of small sandy beaches, with dunes banked against the cliffs. It is from these dunes that Heslop-Harrison & Heslop-Harrison (1938) reported × *C. baltica*. The peaty soil on the cliffs supports a very small and unhealthy population of *C. epigejos*, and in one place, where the cliffs dip towards the beach and sand overlies them, depauperate *A. arenaria* and *C. epigejos* grow in a mixed sward (GR 29/148.475). However, no trace of × *C. baltica* was found there in 1978 or 1982, despite extensive searching. In 1982, in late June, all four of the *C. epigejos* inflorescences were just coming to anthesis, and the *A. arenaria* inflorescences, which were all 30 m below, on the beach, had nearly finished flowering.

No hybrid was found on the beaches at Tarbet or Scourie, the only nearby sandy beaches on the mainland.

Milford on Sea

× *C. baltica* grows in several places on and under a shingle cliff to the west of Milford on Sea (v.c. 11). There were two small patches of it beside the steps at the end of Rook Cliff (GR 40/285.915); just below the cliff at GR 40/283916; and in sand in front of and shingle behind the bathing huts at GR 40/280.917. In 1979 these populations flowered profusely, but in later years they appeared to be declining.

ECOLOGICAL LIMITS

There is a weak positive correlation between the cover abundance of the two taxa, (r = 0·33, Pearson correlation) (Table 3), indicating that they both have a preference for similar general habitats within the dune system.

Analysis of performance characters from quadrats containing either one or both of the taxa (Fig. 3) do show some evidence of competitive interaction between them. Both are significantly reduced in height when they co-occur ($P<0.001$ (× *C. baltica*), and $P<0.05$ (*A. arenaria*), though the differences in number of flowering tillers are not significant.

Analysis of the performance of × *C. baltica* across the range of dune habitats (Fig. 4) show no significant differences between habitats except in tiller height, refuting the possibility that this species is confined to the foredune area.

Further work on the niche requirements of both taxa, and morphological studies which may explain their co-existence, and the survival of × *C. baltica*, will be reported in a later paper.

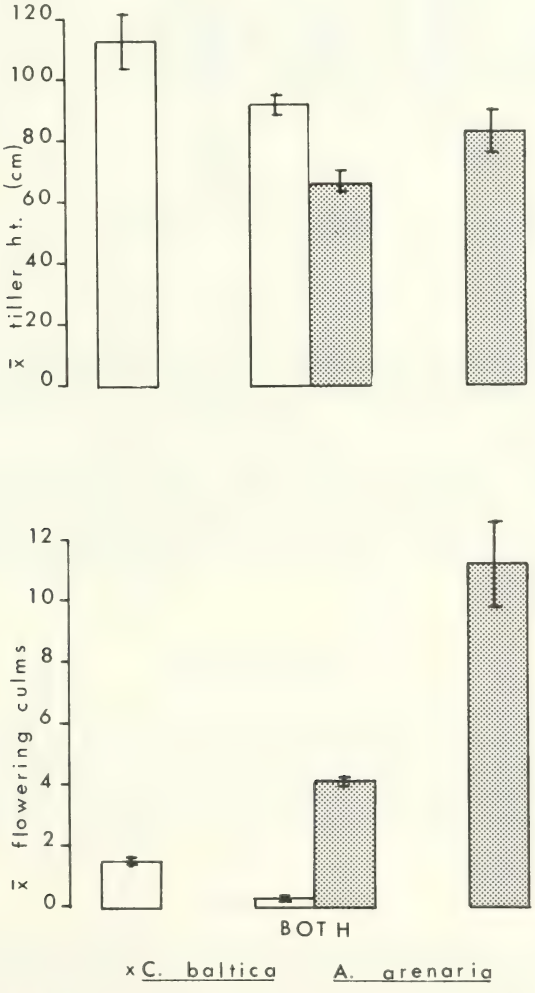

FIGURE 3. Comparison of × *C. baltica* and *A. arenaria* tiller height (above) and flowering (below) in quadrats containing only one, or both of the species. Bar = ±S.E.

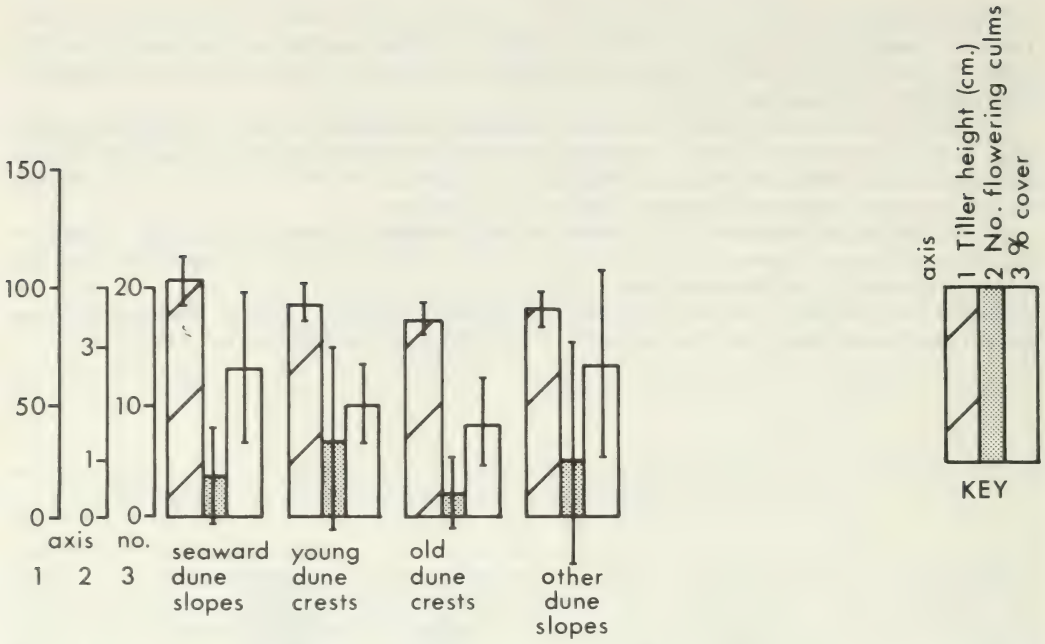

FIGURE 4. × *C. baltica*: mean tiller height, incidence of flowering and % cover in quadrats sorted by habitat. Bar = ± 1 SD^{n-1}

CONCLUSIONS

× *C. baltica*, unlike its marram progenitor, has a very limited distribution in the British Isles, being mainly confined to two areas. It occurs on Ross Links and a few nearby beaches in Northumberland, and along the East Anglian coast, where it is likely that its natural distribution pattern has been radically altered by man.

Ecologically it appears to share much of the niche of *A. arenaria*, in the places where it is found. However there are some signs that, at Horsey, it can survive a more waterlogged soil than Marram. There are also some observations which suggest that the hybrid might be capable of faster recovery from damage, for instance evidence of faster spread in the transplants at Winterton, and along the path in the same blowout.

ACKNOWLEDGMENTS

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REFERENCES

BERGHEN, C. VAN DEN (1964). *La végétation terrestre du littoral de l'Europe occidentale*. Bruxelles.

CLAYTON, K. M., MCCAVE, I. N. & VINCENT, C. E. (1983). The establishment of a sand budget for the East Anglian coast and its implications for coastal stability. *Shoreline Protection*, pp. 91–96. London.

CULWICK, E. G. (1977). *Vegetation survey of Ross Links, Northumberland, July 1977*. Report for the N.E. Regional Office, Nature Conservancy Council.

Doing, H. (1985). Coastal fore-dune zonation and succession in various parts of the world. *Vegetatio* **61**: 65–75.
Ellis, E. A. (1960). The purple (hybrid) marram, *Ammocalamagrostis baltica* (Flügge) P. Fourn. in East Anglia. *Trans. N. Norfolk Nat. Soc.* **19**: 49–51.
Ellis, E. A. (1965). *The Broads*. London.
Heslop-Harrison, J. W. & Heslop-Harrison, H. (1938). The flora of the Island of Handa. *Proc. Univ. Durham Phil. Soc.* **10**: 1–9.
Hubbard, C. E. (1975). *Ammophila* Host × *Calamagrostis* Adans. = × *Ammocalamagrostis* P. Fourn., in Stace, C. A., ed. *Hybridization and the flora of the British Isles*: 576–577. London.
Hultén, E. (1971). *Atlas över Växternas Utbredning i Norden*. Stockholm.
Kenworthy, J. B., ed. (1979). *John Anthony's Flora of Sutherland*. Edinburgh.
Perring, F. H. & Sell, P. D., eds. (1978). *Critical Supplement to the Atlas of the British flora*, 2nd ed., p. 152. Wakefield.
Pohl, R. W. (1968). *How to know the Grasses*, 2nd ed. Iowa.
Richardson, W. (1872). *Ammophila baltica* in Northumberland. *J. Bot.*, N.S. **1**: 21.
Robertson, D. A. (1955). *The ecology of the sand dune vegetation of Ross Links, Northumberland with special reference to secondary succession in the blow outs*. Ph.D. thesis, University of Durham.
Taylor, H. R. & Marsden, A. E. (1983). Some sea defence works in eastern England, in *Shoreline Protection*: 133–143. London.
Trimen, H. (1872). *Psamma baltica* R. et S., as a British Plant. *J. Bot.* N.S. **1**: 353–355.
Tutin, T. G. (1980). *Ammophila* Host, in Tutin, T. G. *et al.*, eds. *Flora Europaea* **5**: 236. Cambridge.
Westergaard, M. (1943). Cyto-taxonomical studies on *Calamagrostis epigejos* (L.) Roth, *Ammophila arenaria* (L.) Link & their hybrids (*Ammophila baltica* (Flügge) Link). *K. Danske Vidensk. Selsk., Biol. Skr.* **2**: 1–66.
Westhoff, V., Bakker, P. A., Leeuwen, C. G. van & Voo, E. E. van der, (1970). *Wilde Planten*, vol. 1. Amsterdam.

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Allium sphaerocephalon L. and introduced *A. carinatum* L., *A. roseum* L. and *Nectaroscordum siculum* (Ucria) Lindley on St Vincent's Rocks, Avon Gorge, Bristol

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ABSTRACT

The Avon Gorge is the only British mainland locality for *Allium sphaerocephalon* L., now a protected plant, of which an unusually large population occurs on St Vincent's Rocks, together with three alien species, *A. carinatum*, *A. roseum* and *Nectaroscordum siculum*, introduced to the Rocks in about 1897. Severe droughts promote flowering of these species but cold winters or long periods of wet and cool conditions have adverse effects. In addition, profound ecological changes, especially the cessation of sheep grazing in 1925, reduced human interference and recent conservation work, have also affected flowering and population sizes. In 1990, a serious outbreak of *Puccinia allii* Rud. (Onion Rust) infected all four species, in each case a new British host record.

INTRODUCTION

St Vincent's Rocks, as marked on Ordnance Survey maps, are sited towards the southern mouth of the Avon Gorge on its west side. The Rocks, composed of Carboniferous limestones, rise to just over 100 m in elevation and are bisected by the Clifton Suspension Bridge. Historically and still at the present day, the Rocks support a rich assemblage of rare, uncommon and interesting plants, including a number of native and alien *Allium* species, which occur there today in quantity.

The Avon Gorge is the only British mainland locality for *A. sphaerocephalon* L., now a protected plant, where it occurs today at two stations about 1·5 km apart; a large population on St Vincent's Rocks and usually a smaller one in The Gully, on the Gully Outcrop. The Rocks also support an abundance of three alien species, *A. carinatum* L., *A. roseum* L. and *Nectaroscordum siculum* (Ucria) Lindley (*A. siculum* Ucria), together with native *A. vineale* L. and, in the vicinity, *A. oleraceum* L.

White (1912) concluded that "some misguided enthusiast" had introduced the three alien species. Lovatt (in Grenfell 1989) produced convincing evidence that the person in question was a Clifton schoomaster, G. H. Wollaston, who had collected propagules of the three species while visiting Sicily and had spread them at the foot of Observatory Hill and on the adjacent cliff-top of St Vincent's Rocks in about 1897.

ALLIUM SPHAEROCEPHALON

This species is a plant of dry, open habitats in the Mediterranean region, extending northwards to Belgium and South Central Russia. Lovatt (1982) reported that his detailed investigations supported a native status of *A. sphaerocephalon* in the Avon Gorge, whereas Moore (1987) regards it as "probably introduced" to the British Isles. The plant just survives today at St Aubin's Bay, Jersey (Le Sueur 1984).

Lovatt (1982) pointed out that the plant has had a curious history in the Avon Gorge being discovered there, new to Britain, on Black Rocks, but not until 1847. It is said that this site was subsequently destroyed by quarrying. The first definite evidence that the plant was growing on the nearby Gully Outcrop came in 1869. Owing to the loose application of the term "St Vincent's

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Rocks" to encompass much of the Clifton side of the Gorge, the first documentary evidence that the plant actually occurred on St Vincent's Rocks *sensu stricto* was when E. Wheeler in 1882 "assured" White that "the plant also grows on St Vincent's Rocks" (Lovatt 1982). White managed to reach the spot that year and found "about 20 specimens" and nearly that number on subsequent visits (White 1912).

Little further evidence of numbers was forthcoming until 1933 when H. Stuart Thompson and J. E. Lousley observed "many hundreds" of flower heads on the Rocks (Lovatt 1982). In 1972, an estimated 2,500 flowering plants were recorded by Bailey *et al.* (1972), and an estimate of at least 4,500 flower heads was reported in 1977 by Bennett & House (1977). In July 1990, only 503 flowering plants were counted on the Rocks, confined to but scattered throughout the upper, mid and lower cliffs, south of the Suspension Bridge.

ALLIUM CARINATUM

A. carinatum is a plant of meadows, heaths and scrub in South and Central Europe, extending northwards to South Sweden. It is naturalized in widely scattered localities in Britain from Cornwall to Kircudbright and Angus, and in North East Ireland.

White (1912) reported that Miss W. Mather and Mr C. Wall first noted three or four flower heads of the plant on Observatory Hill in 1904. In 1911 there were at least 20 flower heads (White 1912). Some 217 flowering plants were recorded in 1972 on St Vincent's Rocks (mostly south of the Suspension Bridge) and an estimated 3,000 on Observatory Hill, concentrated on the unmown eastern rocky ramparts of this Iron Age cliff fort (Bailey *et al.* 1972). In July 1990, on St Vincent's Rocks alone, 261 flowering plants were counted south of the Suspension Bridge and an estimate of at least 15,016 north of the Bridge.

The plant has also spread to more distant parts of Clifton and Durdham Downs. In 1962, I. W. Evans reported it on the Leigh Woods side of the Gorge, where today it is scattered in grassland and scrub and also along the edges of the riverside towpath, where 357 flowering plants were found in July 1990.

ALLIUM ROSEUM

This species is a plant of dry, open habitats in the Mediterranean region. In Britain, it is naturalized, as an escape from gardens, usually in a few localities in most of the counties of south-western, southern and south-eastern England, and southern and western Wales.

White (1912) reported that a little earlier than 1904 Mr C. Wall had noted on Observatory Hill a patch of five or six plants of *A. roseum*, usually picked as soon as the flowers opened, and two smaller patches nearby. About 16 plants of *A. roseum*, "a *bulbiferum* type", were noted by White in 1907 and about the same number in 1909.

Bailey *et al.* (1972) reported 369 flowering plants on St Vincent's Rocks in 1972. In May 1990, the plant was found to be still confined to the Rocks, north of the Suspension Bridge, in two disjunct bands, a little distance apart, but now stretching the whole depth of the cliffs from Observatory Hill above, down to the base of the rocks beside the Portway, the riverside arterial road. An estimated 3,651 flowering plants were present in a narrow band below the Observatory and 12,773 in a wide band to the north of this.

NECTAROSCORDUM SICULUM

Allium siculum Ucria was transferred to the genus *Nectaroscordum* by Lindley (1836). Subsp. *siculum* is a plant of damp or shady woods in the Western Mediterranean region, whilst subsp. *bulgaricum* (Janka) Stearn is a native of south-eastern Europe.

Since 1960 there are published records for *N. siculum* or *A. siculum* as an introduction, escape or planted relic in at least eleven localities in the counties of Avon, Breconshire, Cambridgeshire, Dorset, Essex, Glamorgan, Oxfordshire, Somerset and Surrey. Three of these localities are in

woods, its native habitat. Subsp. *bulgaricum* has been reported in Dorset and Surrey. It is suggested that these records, together with the establishment of the plant for nearly a century on St Vincent's Rocks, warrants mention of this alien in British floras, from which it is almost consistently absent.

White (1912) reported that Mr C.Wall first observed in 1906 on St Vincent's Rocks "a very few plants" of *Allium siculum*, whose flower heads were usually picked or broken-off. The alien has remained, until recently, confined to a concave depression at the cliff-top at St Vincent's Rocks, near the Observatory, apparently the site of its original introduction. Usually only five or six plants flowered each year but the number has increased dramatically in recent years rising to 174 in May 1990, when the plant had also spread to the cliff edge below the original site, and it may even descend the cliffs in due course. The Gorge plant has been determined as subsp. *siculum* by Mr M. Mullin and Dr W. T. Stearn.

EFFECTS OF CLIMATIC CONDITIONS ON FLOWERING PERFORMANCE

The number of flowering plants of the *Allium* species on the Rocks may vary widely from year to year, depending especially on climatic conditions. Both native and alien species usually respond by much increased numbers of flowering plants in the year following a period of severe drought with high temperatures and insolation. Conversely numbers tend to be low following a severely cold winter, which may damage the autumn-emerged leaves, or prolonged periods of very wet, cloudy and cool conditions, especially in spring.

In recent times, the number of flowering plants of *A. sphaerocephalon* on St Vincent's Rocks has ranged from at least 4,500 in 1977, following the dry periods of 1975 and the unique drought of 1976, to 2,858 in 1984 following the dry summer of 1983, but a decrease to 2,532 in 1985, after the droughted summer of 1984, counteracted by the severe winter of 1984–5. In contrast, only 254 flowering plants were recorded on the Rocks in 1986 following the severe frosts throughout February and early March that year, and a mere 29 in 1989, after the wet summer of 1988 followed by a cold November and in 1989 an exceptionally wet period, from February to April inclusive, with rainfall 70·9% above average (Houston 1991).

PAST AND PRESENT MANAGEMENT PRACTICES

The increased number of flowering plants of *Allium* species in more recent times is due in part to profound alterations in ecological conditions resulting from changes in management practices. Micklewright & Frost (1989) detailed the history of sheep grazing on the Downs and accessible areas of the Gorge cliffs from the Anglo-Saxon Charter of 883 to the cessation of regular grazing in 1925. In Medieval times the Downs were heavily grazed, with evidence of overgrazing at times. In the mid-18th century, the Commoners of Durdham Down had the right to graze 1,885 sheep and the Commoners of Clifton Down 880 sheep and 14 "neats" (cattle). However, by 1847, the Commoners of Clifton Down had ceased to exercise their rights, and in 1872 only three to four hundred sheep were grazing the Downs.

The sheep probably grazed-off *Allium* leaves and inflorescences and it is interesting to note that the first flowering plants of *A. sphaerocephalon* were found on "steep declivities of the cliffs" at Black Rocks in 1847, when the number of sheep had been considerably reduced, and definite evidence of flowering plants on the readily accessible Gully Outcrop came in 1869, when only a few hundred sheep were grazing the Downs.

Following the cessation of grazing in 1925, mowing machines were employed on the Downs but could not mow the cliff areas which the agile sheep had reached. On the level of cliff tops of St Vincent's Rocks and Observatory Hill, heavily mown today by motorized gang mowers, *A. carinatum* persists but does not flower, perhaps imitating the condition when the area was heavily sheep grazed, as depicted in drawings and paintings of the 18th and 19th centuries.

In the 18th century, parts of St Vincent's Rocks were quarried but Observatory Hill and the cliff tops of St Vincent's Rocks became a favourite area for the citizens of Clifton to promenade, and in recent times to become a tourist 'hot spot'. Although suggested in 1907, photographic evidence indicates that it was not until the late 1930s that a substantial safety fence was installed along the cliff

top, reducing human trampling and thwarting most flower pickers and perhaps even some herbarium collectors. In 1979, walls and fences were erected along the base of the cliffs beside the Portway.

The removal of grazing and human interference led to the establishment of coarse grassland, scrub and trees; only the skeletal-soiled cliff ledges remaining suitable for many of the rare and uncommon plants of the Gorge.

This trend has been reversed by recent changes. Remedial work at intervals since 1978 by Avon County to remove unstable rocks liable to fall on the Portway, has caused considerable disturbance on St Vincent's Rocks and some damage to *A. sphaerocephalon* and other rare plants.

Over the period 1985 to 1989, considerable areas of scrub on the Rocks have been cleared by the Nature Conservancy Council Avon Gorge Warden and the Downs Ranger directing their workteams. The clearance has benefitted both native and alien species. Most dramatic of all has been the clearance in 1986 of the site of *N. siculum*, densely overgrown by *Clematis vitalba*. Since clearance, the number of flowering plants has increased from 5 or 6 to 174 in 1990. *A. carinatum* and *A. roseum* are also already prominent in parts of the scrub-cleared areas.

Micklewright (1985) pointed out that where *A. carinatum* overlaps the distribution of *A. sphaerocephalon*, south of the Suspension Bridge, the closely-packed, superficial bulbs of the alien are competing with the more deeply-seated bulbs of *A. sphaerocephalon*. However, the alien can be selectively removed since both species are in flower at the same time. By pulling gently on the flowering scape, so as not to dislodge the bulbils, the whole alien plant, including the bulb, can be readily uprooted, removed from the site and destroyed. In view of the serious decline of *A. sphaerocephalon* here, 337 vegetative or flowering plants of *A. carinatum*, growing amongst *A. sphaerocephalon*, were removed from the site in the late summer of 1990.

OUTBREAK OF *PUCCINIA ALLII* RUD. (ONION RUST)

Pustules of a rust fungus were found (by LH) in April 1990 on the leaves of *A. sphaerocephalon*, at both its stations, and on *A. vineale*, *A. carinatum*, *A. roseum* and *N. siculum* growing on St Vincent's Rocks. *A. sphaerocephalon* was the most heavily infected of all which probably contributed to its unexpectedly low numbers of flowering plants at both stations in 1990, especially following the severe drought of 1989. Light and scanning electron microscopy of the pustules revealed 2-celled teliospores, a diagnostic character of the genus *Puccinia*, in this case *P. allii* Rud. (Wilson & Henderson 1966). A search of records at the C.A.B. International Mycological Institute indicated that, apart from *A. vineale*, these were all new host records for Britain. Furthermore, *P. allii* is host specific to *Allium* species, subspecies, varieties and hybrids and had never been recorded elsewhere on *A. roseum* or *N. siculum* (Beckett *et al.* 1991).

Lindley (1836) placed *A. siculum* in the new genus *Nectaroscordum* principally because it has a semi-inferior ovary, but added that the plant agreed with the genus *Allium* "in having an umbellate inflorescence and a powerful garlic-like odour but in hardly any other respect". Others have suggested that its peculiarly unpleasant smell indicates a chemical difference from *Allium* species. However, the host specificity of *P. allii* casts some doubt on the validity of such a taxonomic separation (Hijwegen 1988). Indeed White (1912) and some recent authors retain *A. siculum*.

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REFERENCES

BAILEY, E., HENDRY, G., PEARSON, D. & SHEPHERD, T. (1972). *A botanical survey of the distribution and the state of the rare plants in the Avon Gorge, Bristol*. Report to the Nature Conservancy Council, SW Region. The University, Bristol.

BECKETT, A., HOUSTON, L. & FROST, L. C. (1991). New records for *Puccinia allii* Rud. *Plant Pathology* (in press).

BENNETT, D. & HOUSE, K. (1977). *A botanical survey of the distribution of the rare plants of the Avon Gorge, Bristol, with particular reference to the severe drought of 1976*. Report to the Nature Conservancy Council, SW Region. The University, Bristol.

GRENFELL, A. L. (1989). A review of the alien and introduced plants of the Avon Gorge, in FREY, A. E., ed. *The Avon Gorge*, pp. 33–44. Bristol.

HIJWEGEN, T. (1988). Coevolution of flowering plants with pathogenic fungi, in PIROZYNSKI, K. A. & HAWKSWORTH, D. L., eds. *Coevolution of fungi with plants and animals*, pp. 63–77. London.

HOUSTON, L. (1991). Population counts in 1987, 1988 and 1989 of rare and uncommon plants in the Avon Gorge, Bristol, with analyses and comments. *Avon Gorge Project Report No. 16*. The University, Bristol.

LE SUEUR, F. (1984). *Flora of Jersey*. Jersey.

LINDLEY, J. (1836). *Nectaroscordum siculum*. Sicilian Honey-garlic. *Edwards's Bot. Reg., Lond.* **22** (NS 9), ill 1912 and text (latter misnumbered 1913).

LOVATT, C. M. (1982). *The history, ecology and status of the rare plants and the vegetation of the Avon Gorge, Bristol*. Ph. D. Thesis, University of Bristol.

MICKLEWRIGHT, S. D. (1985). A survey of historical land use, present vegetation types and localities of rare and uncommon plants on the Clifton side of the Avon Gorge with conservation management recommendations. *Avon Gorge Project Report No. 4*. The University, Bristol.

MICKLEWRIGHT, S. D. & FROST, L. C. (1989). Historical land use of the Bristol Downs as common of pasture, in FREY, A. E., ed. *The Avon Gorge*, pp. 21–26. Bristol.

MOORE, D. M. (1987). Liliaceae, in CLAPHAM, A. R., TUTIN, T. G. & MOORE, D. M. *Flora of the British Isles*, 3rd ed. Cambridge.

WHITE, J. W. (1912). *The flora of Bristol*. Bristol.

WILSON, M. & HENDERSON, D. M. (1966). *British rust fungi*. Cambridge.

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Orchis purpurea Hudson in the Avon Gorge, Bristol

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ABSTRACT

The discovery of a single flowering specimen of *Orchis purpurea* Hudson (Orchidaceae) in Leigh Woods, Avon Gorge, Bristol, in May 1990 is reported. The main features of this Carboniferous limestone habitat are briefly described and a short account of the associated vegetation is given. The occurrence of the Lady Orchid in this site is discussed with reference to its distribution in Britain and on the Continent and to its phenology and modes of dispersal.

INTRODUCTION

A single specimen of the Lady Orchid (*Orchis purpurea* Hudson) was found (KBT, conf. MHM, AJW) on the Carboniferous limestone of Leigh Woods in the Avon Gorge, Bristol, v.c. 6, on 6 May 1990. The plant was well grown, with five large leaves and a smaller one, and an inflorescence 42 cm tall bearing about 30 flowers, nearly all fully open when first seen. A single flower was taken on 9 May as a voucher specimen (**herb. AJW**). The labellum was flushed pink, with distinct reddish-purple spots throughout. The lateral lobes of the labellum were quite well developed, the large median lobe bearing a small but distinct central tooth between its two lobules. Of the two variants of the species recognized by Rose (1948) in Kent, the Leigh Woods plant resembled the western one more closely than the eastern one, having a fairly dense flowering spike and short ovary, as well as heavy spotting on the lip.

HABITAT

The site was a wooded slope in Leigh Woods on the Somerset (W.) side of the Avon Gorge, where the soil is deeper and moister than on the more precipitous eastern city side (Gloucestershire). The angle of slope in the general area was about 20° and the aspect approximately south-east.

The major contributor to the canopy was *Fraxinus excelsior*, these small trees being mostly 3–5 m tall (with some up to 6 m) and 3–8 cm in diameter (at breast height). Although the canopy was fairly complete, there were some breaks, with sunflecks reaching the ground flora. The soil was moderately moist and quite deep for this woodland, ranging from 28 to 52 cm, with a mean value (10 estimates, by use of a thin steel probe) of 37 cm. Fragments of limestone were present but there was only a little exposed rock in the general vicinity. When dry, the surface soil colour was a very grey brown, becoming blackish-brown when wet. This indicated organic enrichment, the surface

containing a substantial amount of leaf mould. Below this enriched layer was a reddish silty B horizon. With respect to soil texture, a sample when wet moulded easily into fragile 'fingers' indicative of an organic rich silt loam in the distinct A horizon. In the surface soil the pH (direct readings after dampening with deionized water) was 6·7–7·0 and in the sub-surface (at about 2 cm) was 7·0–7·1.

VEGETATION

Although there were no very large trees at the site, the tree layer was substantial, with abundant *Fraxinus excelsior*, frequent *Corylus avellana* and occasional *Acer pseudoplatanus* and *Ulmus glabra*. Nearby were *Acer campestre*, *Crataegus monogyna*, *Rubus fruticosus* agg., *Sambucus nigra* and *Viburnum opulus*. The ground flora was moderately open, and quite strongly dominated by *Mercurialis perennis*. Also present were *Arum maculatum*, *Hedera helix* and *Hyacinthoides non-scripta*, together with the ferns *Dryopteris filix-mas* and *Asplenium scolopendrium*. The quite thick moss carpet included *Brachythecium rutabulum*, *Eurhynchium swartzii*, *Plagiomnium undulatum* and *Thamnobryum alopecurum*, with other mosses nearby characteristic of soil and rocks of these woods (Willis 1964). Additional species in the vicinity included *Brachypodium sylvaticum*, *Carex sylvatica*, *Circaea lutetiana, Deschampsia cespitosa, Festuca gigantea, Geranium robertianum*, *Lathraea squamaria* (on *Corylus*), *Melica uniflora*, *Taraxacum officinale* agg., *Urtica dioica* and *Viola riviniana*.

THE DISTRIBUTION OF *O. PURPUREA*

In Britain this orchid has a distinctly south-eastern distribution (Summerhayes 1951; Perring & Walters 1962). It is now known almost only from the chalk in Kent, where it grows in scrub coppice under moderate light and shelter from extreme dryness and wind, and in chalk escarpment beechwoods in fairly deep shade, mostly on the lower, south-facing slopes (Rose 1948). It was recorded from N. Essex in 1738 (Hall 1936), from a site apparently on chalky boulder clay in Walter Belchamp Parish (the date of 1935 for this record implied by Rose (1948) and Lang (1980) is misleading). *Orchis purpurea* was also formerly known in Surrey where the last record is for 1959 (Leslie 1987). In W. Sussex, where the orchid was always very rare, the most recent published record is also for 1959 (a good year for flowering), on chalk at Chanctonbury Ring (Hall 1980). However, in 1976 a single flowering specimen was found in a site nearby, but unfortunately this was completely destroyed by cattle several years later (Mrs M. Briggs, pers. comm.). In 1961 a flowering specimen was found on the chalk in southern Oxfordshire under beech with *Mercurialis perennis*. It was last seen three years later but in 1986 seven plants (three flowering) were found in a cleared and disturbed area in the same vicinity (Kemp 1987). The colony is still flourishing, flowering well in 1990 (R. J. Kemp, pers. comm.). There is a further record of a single plant from the Lower Old Red Sandstone in Herefordshire in 1967 "under hazels in hazel coppice at edge of beech wood on calcareous subsoil" but this plant has not reappeared (Whitehead 1976). This is the most westerly site for the plant in Britain, Leigh Woods being a little to the east. Virtually all of the British records refer to chalk, the Leigh Woods plant appearing to be the only occurrence on limestone.

Orchis purpurea has a wide distribution in continental Europe where it occurs typically on calcareous base-rich soils, including limestone, as for example in France and Italy. It extends southwards and westwards from Denmark to Germany, France and Spain, and is abundant in the mountains of central Italy. *Orchis purpurea*, classified by Summerhayes (1951) as a member of the southern Eurasian geographical element, is present in many countries bordering the Mediterranean including Algeria and Tunisia. In the east it extends to Greece, Crimea, Caucasus and Turkey.

Ellenberg (1988) gives *O. purpurea* as a member of the alliance *Quercetalia pubescenti-petraeae* of xerothermic mixed Oak woods in Central Europe and for its 'ecological indicator values' lists half-shade, warmth indicator, suboceanic, moderate dampness, and mostly on chalk and limestone.

DISCUSSION

Orchis purpurea may be a recent arrival in Leigh Woods, but could possibly have been present, especially if in only a vegetative state, for many years. Whatever the case, it has every appearance of a native, and is probably not a recent transplant.

Leigh Woods are undoubtedly ancient (Rackham 1982), with a wealth of ancient woodland indicator species (Lovatt 1989), and with a rich limestone flora containing many rarities (White 1912; Hope-Simpson & Willis 1955; Willis 1962). The conditions in Leigh Woods are closely similar to the 'ecological indicator values' for *O. purpurea* given by Ellenberg (1988); also the dominance of the ground flora by *Mercurialis perennis* fully accords with the statement by Rose (1948) that this species is "the most constant and characteristic associate of *O. purpurea* in Britain".

Rose (1948) regards *O. purpurea* as well 'at home' in the mountains of central Italy where it is the most abundant woodland orchid, the winters and springs are cool and wet and the summers extremely dry and sunny. These particular conditions, according to Rose (1948), under which the tubers dry out in the summer, may lead to good seasons for this species. The two last summers (1988, 1989) were quite hot and in 1989 very dry; these climatic conditions, coupled with the very mild winters in these years, may well have favoured the plant in Leigh Woods, leading to its flowering. A further factor may have been the favourable growth conditions for early developing species of the woodland floor in 1990 (leaves of *O. purpurea* may appear above ground in February), enabling good growth to be made before the tree canopy expanded. However, Rose (1948) considers that conditions in the previous year are those which have the most influence on the performance of the plant in the following year. Certainly the high vigour shown by flowering spikes of *O. purpurea* in Kent in 1990 is in full accord with the view that drying of the tuber in summer is beneficial.

Although *O. purpurea* is now largely restricted to Kent in Britain it is possible that the very small seeds may be carried long distances – even across the Channel (Summerhayes 1951); indeed it may be a fairly recent immigrant from the Continent (Rose 1948), although known in Britain since 1666. The origin of the Leigh Woods plant from seed unwittingly carried by a visitor (well-travelled botanists come to the Woods) is not impossible. Another possibility is from wind-borne seed from a batch of orchid species, including *O. purpurea*, grown in 1980–1982 (*O. purpurea* was known to flower and possibly fruit) in the University of Bristol Botanic Garden, North Road, Leigh Woods, from material brought from France. However, scrutiny of photographs of the flowers taken in 1980 of the garden-grown plant shows several differences in shape and markings of the labellum from the Leigh Woods plant, and the specimen of French origin seems to match the eastern rather than the western variant of the species.

The existence of single plants in sites is known, as, for example, in Herefordshire and (originally) in Oxfordshire. It is well established that only a small proportion of plants in a population of *O. purpurea* usually flower in any one year, but no purely vegetative specimens have been seen in Leigh Woods. If the plant persists here it will be a remarkable addition to an already notable flora.

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REFERENCES

Ellenberg, H. (1988). *Vegetation ecology of Central Europe*, 4th ed. Cambridge.
Hall, P. C. (1980). *Sussex plant atlas*. Brighton.
Hall, P. M. (1936). Plant Records. *Rep. botl Soc. Exch. Club Br. Isl.* **11**: 41.
Hope-Simpson, J. F. & Willis, A. J. (1955). Vegetation, in Whittard, W. F. & McInnes, C. M., eds. *Bristol and its adjoining counties*, pp. 91–109. Bristol.
Kemp, R. J. (1987). Reappearance of *Orchis purpurea* Hudson in Oxfordshire. *Watsonia* **16**: 435–436.
Lang, D. (1980). *Orchids of Britain*. Oxford.

Leslie, A. C. (1987). *Flora of Surrey – Supplement and checklist.* Guildford.
Lovatt, C. M. (1989). The historical ecology of Leigh Woods, Bristol. *Proc. Bristol Nat. Soc.* **47**: 3–19.
Perring, F. H. & Walters, S. M. eds. (1962). *Atlas of the British flora*. London.
Rackham, O. (1982). The Avon Gorge and Leigh Woods, in Bell, M. & Limbrey, S. eds. *Archaeological aspects of woodland ecology*. Oxford.
Rose, F. (1948). *Orchis purpurea* Hudson, in Biological Flora of the British Isles. *J. Ecol.* **36**: 366–377.
Summerhayes, V. S. (1951). *Wild orchids of Britain*. London.
White, J. W. (1912). *The flora of Bristol*. Bristol.
Whitehead, L. E. (1976). *Plants of Herefordshire*. Hereford.
Willis, A. J. (1962). Rare plants of the Bristol district. *Rep. Ann. Conf. 1961 and 1962, South Western Nat. Union*. 4 pp.
Willis, A. J. (1964). Bryophytes of Leigh Woods, Somerset. *Proc. Bristol Nat. Soc.* **30**: 451–454.

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Differential pollination efficiency within a hybrid swarm between *Dactylorhiza purpurella* (T. & T. A. Stephenson) Soó and *D. fuchsii* (Druce) Soó

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ABSTRACT

Pollination efficiency, as estimated by frequency of pollinium removal, was studied in a mixed population of *Dactylorhiza purpurella* (T. & T. A. Stephenson) Soó, *D. fuchsii* (Druce) Soó and their hybrid (Orchidaceae). Plants of *D. purpurella* were visited more frequently by vectors than were those of *D. fuchsii* or the hybrid. This may restrict levels of hybridization.

INTRODUCTION

Hybridization has frequently been reported between diploid (2n = 40) *Dactylorhiza fuchsii* (Druce) Soó and tetraploid (2n = 80) marsh orchids sometimes classed within *D. majalis* (Reichenb.) P. F. Hunt & Summerhayes (Bateman & Denholm 1983). Lord & Richards (1977) found backcrossing in a Co. Durham population hybrid between *D. fuchsii* and *D. purpurella* (*D. majalis* subsp. *purpurella* (T. & T. A. Stephenson) D. M. Moore & Soó), such that presumptive backcrosses had aneuploid chromosome numbers. They suggested that the degree of contribution to the hybrid made by *D. purpurella* could be estimated by the chromosome number. Complex hybrids within such hybrid swarms appear to be fairly fertile, suggesting that *D. fuchsii* may itself be ancestrally polyploid.

Dactylorchids only set seed after pollinia are transferred from the anther of one flower into the stigmatic cavity of another as the result of an insect visit. There appears to be no published information concerning visitors or rewards for *D. majalis* agg., although we have frequently observed and photographed *Bombus* spp., especially the queens of *B. terrestris*, visiting the flowers of *D. purpurella*.

D. fuchsii is visited by *B. lapidarius*, *B. terrestris* and *Apis mellifera* (Dafni & Woodell 1986). Other visitors including various diptera and lepidoptera do not transport pollinia. Those authors record an average fruit set for *D. fuchsii* of 54%, but note that the lower (earlier) flowers set more than twice as many capsules as the upper flowers on the spike.

Grant (1981), for instance, provides many examples of potentially interfertile sympatric species-pairs whose specific identity is largely preserved by ethological isolation. Hybridization following the breakdown of ethological isolation is particularly frequent in the Orchidaceae (review in Dafni (1986)), notably in *Orchis* and *Ophrys*.

Very little attention seems to have been paid to the pollination of hybrids, perhaps because they are frequently sterile. Although it has been suggested that fertile hybrids may be maladapted to successful pollination in comparison to their parents (e.g. Dafni 1986), and thus by implication that this maladaptation reinforces the genetic isolation of their parents, only Grant (1952) provides any data to this effect.

In the present study, pollination efficiency, judged by rates of pollinium removal, is studied in a hybrid swarm between *D. purpurella* and *D. fuchsii*.

METHODS

Every plant in a mixed colony of *D. purpurella* and *D. fuchsii* at Malham Tarn Fen, N.W. Yorks (v.c. 64) (GR 34/887.672) was non-destructively sampled. A hybrid index was formulated as

TABLE 1. CHARACTER STATES USED IN THE HYBRID INDEX

Score	0	2
Leaf spotting	zero, or punctate near apex	larger spots throughout
Labellum colour	red-purple	pale lilac
Labellum pattern	loops	spots
Ratio spur length/width at base	<4·0	>5·0
Ratio length labellum mid-lobe/length labellum	<0·2	>0·4

follows. Plants were assessed for five characters by which *D. purpurella* and *D. fuchsii* differ (Table 1), based on Heslop-Harrison (1957) and Lord & Richards (1977). Plants judged to be intermediate for a character were scored one. Using this simple index, it is considered that plants with a total score of 0 are morphologically typical *D. purpurella*, and those scoring 10 are typical *D. fuchsii*.

To estimate pollen fertility, pollinia were squashed in acetocarmine and examined at × 400. Tetrad cells with regular nucleus formation were scored as fertile, and those with absent or abnormal nucleus formation were scored infertile. Percentage fertility was based on samples of over 50 pollen cells.

To estimate the frequency of pollinium removal, the position of each open flower on the spike and the number of pollinia removed from it was noted.

RESULTS AND CONCLUSIONS

1. Most plants in the population are *D. purpurella*, or hybrid. From hybrid index scores, it is likely that only between one and three plants are referable to *D. fuchsii* (Table 2).
2. Most plants show a high level of apparent pollen fertility, and consequently this character is of little use in assessing hybrid status. However the relatively low apparent fertility of plants scoring 6 suggest that these might be F_1 hybrids (Table 2).
3. There is a progressive reduction in the proportion of pollinia removed from flowers as the hybrid index score increases (Table 1). There is a significantly greater proportion of plants from which some pollinia have been removed for plants scoring 0–3 (plants resembling *D. purpurella* in floral characters) than from those with higher scores (*D. fuchsii* and hybrids) (Table 3).
4. There is no overall significant difference in flowering time or vigour as assessed by the number of open flowers, including the bottom-most, between plants of different hybrid index scores (Table 3). It is therefore concluded that differences in levels of pollinium removal are not due to the size or maturity of the flowering spikes, but result from pollinator choice.

TABLE 2. HYBRID INDEX SCORES, AVERAGE POLLEN FERTILITY, AND AVERAGE PERCENTAGE POLLINIUM REMOVAL OF PLANTS SAMPLED, ± STANDARD DEVIATION

Hybrid index score	Average pollen fertility	Average percentage pollinium removal	No. of plants
0	84·6±19·6	36·6± 6·7	22
1	91·5± 8·1	39·4± 5·8	14
2	89·9±11·3	29·0± 5·6	16
3	89·7± 7·7	28·5± 3·1	14
4	94·1±22·4	12·5±15·8	4
5	83·5±18·6	17·4±17·0	5
6	57·9± 9·9	0	3
7	92·3± 3·2	8·5±12·0	2
8	33·3	0	1
9	87·5	0	1
10	78·8	0	1

TABLE 3. POLLINIUM REMOVAL AND MEAN NUMBER OF FLOWERS OPEN FOR PLANTS WITH DIFFERENT CLASSES OF HYBRID INDEX SCORES

Pollinium removal	Hybrid index score			No. of plants
	0–3	4–6	7–10	
All intact	22	7	4	33
Some removed	43	5	1	49
Chi-square (df = 2) = 6·33, $p<0·05$				
Average number of flowers open	2·88	3·42	3·0	

5. It is concluded that *D. purpurella*-like plants in this population are more efficiently visited by insects than hybrids. This may restrict levels of hybridization.

From a very small sample, it seems that the minority species *D. fuchsii* may also be poorly visited, perhaps because it presents a different, unusual, search-image to visitors. It is possible that hybrids also suffer by presenting a different search-image to visitors in comparison with the dominant *D. purpurella*. However, it is noteworthy that although *Bombus* spp. which visit *D. purpurella* were commonly present, few if any *Apis*, the major pollinator of *D. fuchsii* (Dafni & Woodell 1986) were observed.

REFERENCES

Bateman, R. M. & Denholm, I. (1983). A reappraisal of the British and Irish dactylorchids, 1. The tetraploid marsh-orchids. *Watsonia* **14**: 347–376.

Dafni, A. (1986). Pollination in *Orchis* and related genera, in Arditti, J., ed. *Orchid biology, reviews and perspectives*, pp. 81–103. Ithaca.

Dafni, A. & Woodell, S. R. J. (1986). Stigmatic exudate and the pollination of *Dactylorhiza fuchsii* (Druce) Soó. *Flora* **178**: 343–350.

Grant, V. (1952). Isolation and hybridization between *Aquilegia formosa* and *A. pubescens*. *Aliso* **2**: 341–360.

Grant, V. (1981). *Plant speciation*, 2nd ed. New York.

Lord, R. M. & Richards, A. J. (1977). A hybrid swarm between the diploid *Dactylorhiza fuchsii* (Druce) Soó and the tetraploid *D. purpurella* (T. & T. A. Steph.) Soó in Durham. *Watsonia* **11**: 205–210.

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A new dactylorchid hybrid

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ABSTRACT

An account is given of a new hybrid from Cardiganshire (v.c. 46), *Dactylorhiza* × *dinglensis* (Wilmott) Soó nothosubsp. **robertsii** F. Horsman, **nothosubsp. nov.** (*D. majalis* (Reichenb.) P. F. Hunt & Summerhayes subsp. *cambrensis* (R. H. Roberts) R. H. Roberts × *D. maculata* (L.) Soó subsp. *ericetorum* (E. F. Linton) P. F. Hunt & Summerhayes).

INTRODUCTION

In 1987 I visited a locality near Borth (Cards., v.c. 46) which was one of the two sites from which Roberts (1961b) described *Dactylorhiza majalis* (Reichenb.) P. F. Hunt & Summerhayes subsp. *cambrensis* (R. H. Roberts) R. H. Roberts and which has the largest known population of that taxon. In 1988 I counted nearly 1500 flowering spikes. This suggests the population has maintained its size since Roberts first saw it 30 years ago (Roberts, pers. comm.). Ellis (1983) records *D. majalis* subsp. *cambrensis* from only four 10-km squares in Wales.

In common with Roberts (1961a), the only other dactylorchid I found in the Borth locality in 1987 and 1988 was *D. maculata* (L.)Soó subsp. *ericetorum* (E. F. Linton) P. F. Hunt & Summerhayes. In 1987 I observed plants intermediate in morphology between *D. majalis* subsp. *cambrensis* and *D. maculata* subsp. *ericetorum* which were presumably hybrids, a conclusion confirmed by Roberts. A further visit was made to the site in 1988 to study the hybrid and its putative parents.

The hybrid was noticed on my first brief visit because its spur seemed to be intermediate between the two other taxa present, but only a few such plants were seen. In 1988, however, I found the hybrid to be common. The pale lilac colour of the flower, together with the shape of the lip and its markings, were sufficiently distinctive to enable a reliable estimate of the number of hybrids to be made.

The Borth locality consists of wet meadowland and grassland on old stabilised sand dunes, both of which have a rich flora. The dactylorchids are confined to the wet meadowland. The hybrid is common on the two sides of the site which adjoin an old river bed containing a brackish-water marsh. *D. maculata* subsp. *ericetorum* is most common on one of these two sides where a wide range of intermediates between it and *D. majalis* subsp. *cambrensis* is concentrated.

It is intriguing to note that Stephenson & Stephenson (1921), in describing *Orchis latifolia* from this site, could well have been referring to this hybrid when they stated: "Here are many dark forms along with some lighter ones which may be hybrids, where *O. ericetorum* is present, but no trace of *O. praetermissa*".

The hybrid is confined to the Borth site, exact details of which are witheld for conservation reasons. No other sites are known where *D. maculata* subsp. *ericetorum* and *D. majalis* subsp. *cambrensis* grow in close proximity.

Evidence of the presence of a third dactylorchid was found at the site in 1988. A solitary flowering spike of what Roberts suspects, from my colour photographs, may have been an F_2 hybrid or backcross derived from *D. fuchsii* and *D. majalis* subsp. *cambrensis* was found. It was growing on the border of the wet meadowland and the grassland of the old sand dunes. As *D. fuchsii* grows fairly close by, such a find was not surprising.

TAXONOMY AND NOMENCLATURE

Bateman & Denholm (1983) made *D. praetermissa*, *D. traunsteineri* and *D. purpurella* subspecies of *D. majalis*. Heslop-Harrison (1954) treated them as species, a view with which I concur. In the

British Isles *D. majalis* has three subspecies, subsp. *occidentalis* (Pugsley) P. D. Sell, subsp. *cambrensis* (R. H. Roberts) R. H. Roberts and subsp. *scotica* Nelson. *D. majalis* subsp. *majalis* is confined to Continental Europe, where it is also represented by subsp. *alpestris* (Pugsley) Senghas.

Bateman & Denholm (1983) reduced *D. majalis* subsp. *cambrensis* to *D. majalis* subsp. *occidentalis* var. *cambrensis* (R. H. Roberts) Bateman & Denholm. The reduction of *D. majalis* subsp. *cambrensis* to varietal status is rejected for the following reasons. Bateman & Denholm (1983) state that Roberts (1961b) separated *D. majalis* subsp. *cambrensis* from *D. majalis* subsp. *occidentalis* primarily by the broader leaves and narrower spurs of the plants in the population of *D. majalis* subsp. *occidentalis* measured by Heslop-Harrison (1953), in Co. Clare, v.c. H9, Ireland. *D. majalis* subsp. *cambrensis* is not accepted as a subspecies by Bateman & Denholm (1983) because "Unfortunately, this population was atypical of var. *occidentalis* in these characters".

Heslop-Harrison (1953) measured the maximum width of the *longest* leaf, and the width of the spur *at about a millimetre from the mouth* when flattened. He emphasises that the 'width' figure represents, therefore, not the diameter, but approximately half the circumference at this point. Bateman & Denholm (1983) measured the maximum width of the *widest* sheathing leaf (it must be pointed out that the widest leaf is not necessarily the longest), and the width of the spur *at the entrance* when flattened.

Heslop-Harrison's and Bateman's & Denholm's data are not, therefore, compatible in these two respects. However, Roberts' (1961a, 1961b) data are compatible with those of Heslop-Harrison (1953).

Hybrids involving *Dactylorhiza majalis* subsp. *cambrensis* have previously only been reported from Anglesey (v.c. 52) (Ellis 1983). The other putative parents were *D. purpurella* (T. & T. A. Stephenson) Soó and *D. fuchsii* (Druce) Soó subsp. *fuchsii*. This paper reports the occurrence of a third hybrid with *D. majalis* subsp. *cambrensis* which is previously undescribed.

The name *D.* × *townsendiana* (Rouy) Soó has previously been used for hybrids between *D. maculata* and *D. majalis* (as defined here). The basionym for this name is *Orchis* × *braunii* Halácsy var. *townsendianus* Rouy in Rouy & Fouc., *Fl. Franç.* **13**: 173 (1912). This in turn is based on *Orchis latifolia–maculata* Townsend, *Fl. Hampshire* 2nd ed., 409 (1904), hence the specific epithet. *D. majalis* does not grow in Hampshire and I believe the plant is *D. maculata* × *praetermissa*. The name *D.* × *dinglensis* (Wilmott) Soó is, however, almost certainly referable to *D. majalis* subsp. *occidentalis* × *maculata* subsp. *ericetorum* and that must be called nothosubsp. *dinglensis*. The new hybrid between *D. majalis* subsp. *cambrensis* and *D. maculata* subsp. *ericetorum* I call nothosubsp. *robertsii* after R. H. Roberts, in recognition of his contribution to the study of *Dactylorhiza* and for all the generous help he has given to the Botanical Society of the British Isles as its *Dactylorhiza* referee for nearly 20 years.

D. majalis subsp. *occidentalis* is not known to occur in Wales. *D. majalis* subsp. *cambrensis* differs from *D. majalis* subsp. *occidentalis* in having much longer, narrower and more rigid leaves, and much wider spurs (Roberts 1961b). *D.* × *dinglensis* nothosubsp. *robertsii* differs from *D.* × *dinglensis* nothosubsp. *dinglensis* in having a wider spur with a throat closer in width to *D. majalis* subsp. *cambrensis*.

MEASUREMENTS

In order to quantify the key differences between the hybrid and its parents, one flower from the mid portion of the inflorescence was removed from each of approximately 30 plants of *D. majalis* subsp. *cambrensis*, *D. maculata* subsp. *ericetorum* and their hybrid in 1989 from the Borth locality. The width of the spur throat was obtained by supporting each flower on a plasticine-type material which enabled the flower to be manoeuvred into position for measurement. A high quality steel rule was gently rested on the mouth of the throat and the width at this point measured through a × 10 magnifying glass. The labellum and spur were then excised from the flower as an integral unit and mounted underside uppermost on transparent glue on white card. The spur length and width were measured as soon as possible after mounting. Spur length measured was equal to character 2 in Fig. 1a of Bateman & Denholm (1989). Spur width was measured at the point where character 1 meets character 2 in the same figure.

The results are tabulated in Table 1.

TABLE 1. SPUR DIMENSIONS FOR *DACTYLORHIZA* × *DINGLENSIS* NOTHOSUBSP. *ROBERTSII* AND ITS PARENTS
(N = sample size, S.D. = standard deviation)

	Spur throat width (mm)			Spur length (mm)			Spur width (mm)		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
D. majalis subsp. *cambrensis*	30	2·51	0·25	30	7·87	0·73	29	2·61	0·25
D. × *dinglensis* nothosubsp. *robertsii*	30	2·18	0·15	28	8·30	0·66	27	2·08	0·35
D. maculata subsp. *ericetorum*	27	1·81	0·16	30	6·52	0·90	30	1·19	0·22

DESCRIPTION

Dactylorhiza × **dinglensis** (Wilmott) Soó nothosubsp. **robertsii** F. Horsman, **nothosubsp. nov.**
Dactylorhiza majalis (Reichenb.) P. F. Hunt & Summerhayes subsp. *cambrensis* (R. H. Roberts) R. H. Roberts × *D. maculata* (L.) Soó subsp. *ericetorum* (E. F. Linton) P. F. Hunt & Summerhayes.
HOLOTYPUS: Near Borth, Cards., v.c. 46, wet meadows, 17 June 1988, *F. Horsman V88.58.1* (**NMW**).

Calcar floris 8·3 mm longum, 2·1 mm latum, crassitudine *D. majalis* subsp. *cambrensi* propinquior, utriusque parentis calcare longior, nonnunquamque perspicue maculatum, eius faux 2·2 mm lata, latitudine *D. majalis* subsp. *cambrensis* propinquior.

Spur of flower 8·3 mm long, 2·1 mm wide, closer in thickness to that of *D. majalis* subsp. *cambrensis* and longer than in either parent, sometimes clearly spotted, its throat 2·2 mm wide, closer to that of *D. majalis* subsp. *cambrensis*.

Roots not examined. Average height c. 30 cm. Stem c. 5 mm in diameter at third lowest expanded leaf node, solid, suffused purplish from between first and second non-sheathing leaves upwards, faint at first but increasing in intensity, ridged from lowest non-sheathing leaf upwards. Basal sheath brown. Expanded sheathing leaves commonly 5, non-sheathing leaves commonly 3, 80% of expanded sheathing leaf nodes commonly in lowest 25% of stem. Expanded leaves – lowest c. 10 × c. 2 cm, becoming longer and narrower up the stem to the fourth (c. 13 × c. 1·25 cm) with the uppermost c. 10 × c. 1 cm; non-sheathing leaves – lowest c. 5·5 × 0·75 cm, becoming shorter and narrower up the stem to uppermost (c. 2·75 × c. 0·5 cm); lower floral bracts exceeding flowers, lowest c. 2·5 × 0·5 cm; all leaves widest between base and middle and becoming progressively more erect up the stem; leaves grey-green, the upper expanded leaves darker; lowest expanded leaf blunt and keeled, higher expanded leaves becoming acute and very shallowly hooded; lowest non-sheathing leaf tapering from c. one-third length from base; spots on upper surfaces of expanded leaves, maximum diameter on lower leaves c. 2·5 mm and on upper c. 1·5 mm, some of those on lower leaves transversely elongated or ± oval, fewer transversely elongated on upper leaves, very high density on middle leaves, distributed towards leaf margins and only c. 10% in upper half of leaf, very few spots on uppermost expanded leaf; upper non-sheathing leaves faintly suffused with purple. Inflorescence c. 20% of total stem length, c. 2 × as long as wide, c. 5 flowers/cm, fragrant, cylindrical. Flowers pale lilac; outer lateral perianth segments spreading to drooping, faintly marked with blotches and lines; median outer perianth segment unmarked. Forward edges of inner lateral perianth segments deeper in colour; labellum shape as in Fig. 1, *basic* pattern of markings – 2 adjacent loops in central part, elongated and narrowed towards mid-lobe, loops ± continuous through spur throat and within the upper part of each loop is another elongated loop, but pattern of markings in central part of labellum exhibiting great variability; lateral lobes very slightly reflexed, with few rather faint marks; spur rather longer than ovary, tapering gradually for approximately one-third of its length from base and then more rapidly, with a gentle upward sweep to a point.

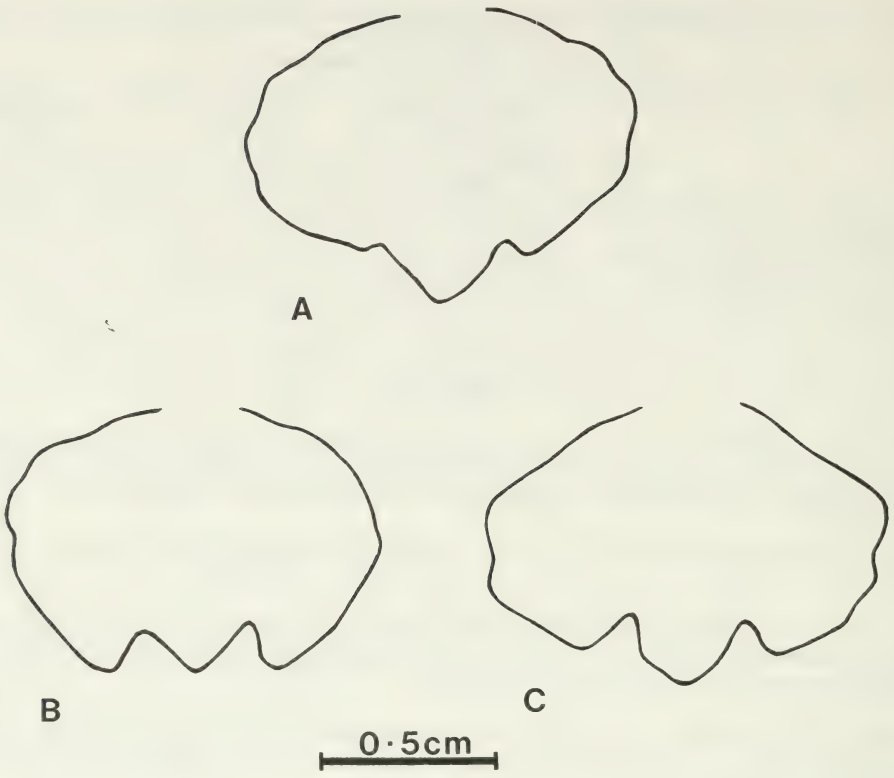

FIGURE 1. Labellum shapes in *Dactylorhiza* × *dinglensis* nothosubsp. *robertsii* and its parents. A. *D. majalis* subsp. *cambrensis*, B. *D.* × *dinglensis* nothosubsp. *robertsii*, C. *D. maculata* subsp. *ericetorum*.

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REFERENCES

BATEMAN, R. M. & DENHOLM, I. (1983). A reappraisal of the British and Irish dactylorchids, 1. The tetraploid marsh-orchids. *Watsonia* **14**: 347–376.

BATEMAN, R. M. & DENHOLM, I. (1989). Morphometric procedure, taxonomic objectivity and marsh-orchid systematics. *Watsonia* **17**: 449–455.

ELLIS, R. G. (1983). *Flowering plants of Wales*. Cardiff.

HESLOP-HARRISON, J. (1953). Studies in *Orchis* L. II. *Orchis Traunsteineri* Saut. in the British Isles. *Watsonia* **2**: 371–391.

HESLOP-HARRISON, J. (1954). A synopsis of the dactylorchids of the British Isles. *Ber. geobot. ForschInst. Rübel* **1953**: 53–82.

ROBERTS, R. H. (1961a). Studies on Welsh orchids, I. The variation of *Dactylorchis purpurella* (T. & T. A. Steph.) Vermeul. in North Wales. *Watsonia* **5**: 23–36.

ROBERTS, R. H. (1961b). Studies on Welsh orchids, II. The occurrence of *Dactylorchis majalis* (Reichb.) Vermeul. in Wales. *Watsonia* **5**: 37–42.

STEPHENSON, T. & STEPHENSON, T. A. (1921). *Orchis latifolia* in Britain. *J. Bot., Lond.* **59**: 1–7.

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Short Notes

ANTHYLLIS VULNERARIA L. SUBSP. *POLYPHYLLA* (DC.) NYMAN, AN ALIEN KIDNEY-VETCH IN BRITAIN

Anthyllis vulneraria (Kidney-Vetch) is a most variable species, both in Britain and Ireland and in Europe. Five subspecies have been recognized in these islands (Cullen 1976, 1986; Akeroyd 1988), three of them native: subsp. *vulneraria*, the most widespread variant, subsp. *lapponica* (Hyl.) Jalas, in Scotland and northern and western Ireland, mainly in the mountains and near the coast, and subsp. *corbieri* (Salmon & Travis) Cullen, a rare plant of coastal cliffs and sand-dunes in western Britain. Two other subspecies, subsp. *carpatica* (Pant.) Nyman and subsp. *polyphylla* (DC.) Nyman are adventive, both perhaps introduced in forage and amenity plantings. In recent years, subsp. *carpatica* (present in Britain and Ireland as var. *pseudovulneraria* (Sag.) Cullen) has expanded its range considerably in Britain, although apparently less so in Ireland (Scannell & Synnott 1987), mainly as a plant of grass and legume mixtures sown on new road verges, embankments and roundabouts. Subsp. *polyphylla*, on the other hand, is now a scarce and perhaps extinct plant in Britain – it has not been reported from Ireland – although it was collected or recorded in several localities from Dorset to Moray in the 1950s to the 1970s. There are no records after 1973.

A. vulneraria L. subsp. *polyphylla* (DC.) Nyman, *Consp. Fl. Eur.* 164 (1878)
Short-lived perennial. Stems 30–50 cm, erect, pubescent with appressed to patent hairs or more or less glabrous below, glabrous above. Basal and lower cauline leaves inequifoliate, with 3–5 pairs of lateral leaflets; upper cauline leaves subequifoliate, with 3–6(–7) pairs of leaflets. Inflorescences usually several on each stem, some lateral and sessile. Calyx rather narrow, concolorous (i.e. without a red tip), the hairs appressed. Corolla yellow.

I have traced the following records:
v.c. 9, Dorset. Briantspuddle, parish of Alfpuddle, roadside, 3.7.62, *T. Woodisse 1*, **BM**.
v.c. 22, Berks. Maidenhead, by A423 at junction of M4 (GR 41/88.78), grass bank on chalk, 12.6.66, *I. K. Ferguson 1378*, **TCD**.
v.c. 23, Oxon. Near Thame, chalk pit, 7.6.64, *J. Rogerson*. Intermediate between subsp. *polyphylla* and subsp. *vulneraria*, det. J. Cullen. B.R.C. card.
v.c. 29, Cambs. Near Burwell (GR 52/575.653), bank of old railway line, 22.6.66, *P. D. Sell 66/26*, **CGE** (reported in Crompton & Wells 1990).
v.c. 51, Flints. Melinden, 1 km south of Prestatyn (GR 33/169.801), limestone quarry, 29.5.61, *R. K. Brummitt, J. Cullen & P. E. Gibbs 61.195*, **LIV**; Trelogan (GR 33/12.80), rough grass, *K. S. Kandall*, det. J. Cullen. B.R.C. card.
v.c. 85, Fife. Tentsmuir, Long Road (near Poles' Camp), *E. Crapper*, 26.7.56, **STA**; near Kinshaldy, edge of Tentsmuir forest (GR 37/48.23), in hayfield, chiefly *Lolium*, 30.7.65, *A. Angus 5176*, **STA**.
v.c. 89, E. Perth. c.1/2 mile south of Pitlochry (GR 27/95.57), main road embankment, 12.7.66, *M.McC. Webster 10738*, **BM**, **RNG**.
v.c. 95, Moray. Near Randolph's Leap, Dunphail, road-verge, 3.7.61, *M.McC. Webster 5965*, **ABN**, **CGE**, **E**, **RNG**; Elgin, golf course, car-park, 12.8.70, *M.McC. Webster 13335*, **CGE**; Whitemire (GR 28/98.54), bank by road, 18.6.73, *M.McC. Webster*, **CGE**.
v.c. 96, Nairn. Near Kilravock, road verge, 1.8.62, *M.McC. Webster*, **CGE**; Auldearh (GR 28/9.5), station yard, 9.6.67, *M.McC. Webster 11266*, **ABN**, intermediate between subsp. *polyphylla* and subsp. *vulneraria*; Allanburn, Newton Hotel, 27.6.63, *M.McC. Webster*, **CGE**.

Comparative descriptions of the five British subspecies are given in Akeroyd (1988), and they have been illustrated by Stewart (1987). Perhaps the most obvious feature of subsp. *polyphylla* is the

many pairs of lateral leaflets of the basal and lower cauline leaves. The most similar of the other subspecies in Britain is subsp. *carpatica*, which differs mainly in the inequifoliate cauline leaves and the more swollen calyx with somewhat spreading hairs. The tall, erect habit of both subspecies is distinctive in the field.

The erect habit reflects the sometime use of subsp. *carpatica* and subsp. *polyphylla* as forage plants that can be cut readily during hay-making. This growth habit is in contrast to the often prostrate or weakly ascending habit of subsp. *vulneraria* and subsp. *lapponica* in natural and semi-natural grassland. A similar pattern of differentiation exists between *Medicago sativa* L. subsp. *sativa* (Alfalfa or Lucerne) and subsp. *falcata* (L.) Arcangeli (native variant), and forage versus native variants of several other legumes, for example *Lotus corniculatus* L. (Bonnemaison & Jones 1986), *Trifolium pratense* L. (Williams 1927) and other clovers, and *Onobrychis viciifolia* Scop. (D. E. Coombe pers. comm.).

About half the British records of *A. vulneraria* subsp. *polyphylla* are from road verges, which suggests that the plants were sown deliberately or accidentally as part of a legume and grass mixture. I have not observed subsp. *polyphylla* in the field in Britain, but have frequently observed subsp. *carpatica*. Typical associates include a tall, erect, fistulose-stemmed variant of *T. hybridum* L. and robust, erect variants of *T. pratense* L. and *T. repens* L., which suggest the deliberate sowing of legumes derived from forage sources, probably the most readily available seed. The native distribution of *A. vulneraria* subsp. *carpatica* var. *pseudovulneraria* has perhaps been obscured by a history of cultivation (Cullen 1976), but the subspecies is generally central European in its distribution. Subsp. *polyphylla* is a plant of central and eastern Europe, and it therefore appears that central Europe may be the source of seed used in at least some roadside landscaping. The use of seed from other regions in road verge plantings has been documented in Finland (Suominen 1974), and the practice has attracted some attention from botanists in Britain in recent years, both from the evolutionary (Bonnemaison & Jones 1986) and the practical and ethical (Dony 1989 and pers. comm.) points of view.

One of the records of *A. vulneraria* subsp. *polyphylla* from Tentsmuir, Fife (v.c. 85). is from a *Lolium* ley, which suggests either the deliberate sowing of subsp. *polyphylla* in a seed mixture or that the plant was present as a contaminant. The other Tentsmuir record, the earliest from Britain, is from near to a former Polish Army encampment, which generates a more colourful hypothesis. Many Polish soldiers, including cavalry units, were stationed in Fife during World War II (as a student in St Andrews in the 1970s I often heard Polish spoken in the town) and it is tempting to postulate that subsp. *polyphylla* was introduced to Tentsmuir with or in the horses' fodder. Many adventive species in Finland were found to be associated with the activities of Russian soldiers and their horses during, and in the decade following, World War II, and several persisted for some years (Niemi 1969).

The peak of records of subsp. *polyphylla* in the mid-1960s may reflect the use of this plant, or its presence as an impurity, in seed mixtures used on the new verges of an expanding and improved road network in Britain. The record from the bank of the recently constructed M4 motorway at Maidenhead may be significant in this respect. The lack of records from the early 1970s to the present, coupled with an increasing number of records of subsp. *carpatica*, may indicate that subsp. *polyphylla* has been replaced in commercial seed mixtures or that the source of these has shifted somewhat. It thus appears to join the list of adventive species that have been only temporarily established in Britain (Salisbury 1961). Nevertheless, the fact that it is a variant of a native species with which it may have hybridized (e.g. the record from Oxon), could mean that traces of its former presence are retained in the gene-pool of *A. vulneraria* in Britain. However, it is not clear to what extent such processes operate in natural populations.

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REFERENCES

AKEROYD, J. R. (1988). *Anthyllis vulneraria* L. in RICH, T. C. G. & RICH, M. D. B. *Plant Crib*, pp. 45–46. London.

BONNEMAISON, F. & JONES, D. A. (1986). Variation in alien *Lotus corniculatus* L. 1. Morphological differences between alien and native British plants. *Heredity* **56**: 129–138.

CROMPTON, G. & WELLS, D. (1990). Vascular plant records. *Nature Cambs.* **32**: 77–80.

CULLEN, J. (1976). The *Anthyllis vulneraria* complex: a resumé. *Notes Roy. Bot. Gard. Edinb.* **35**: 1–38.

CULLEN, J. (1986). *Anthyllis vulneraria* L. in the British Isles. *Notes Roy. Bot. Gard. Edinb.* **43**: 277–281.

DONY, J. G. in BRIGGS, M. (1989). Report of Annual General Meeting, 7 May 1988. *Watsonia* **17**: 382–383.

NIEMI, A. (1969). Influence of the Soviet tenancy on the flora of the Porkala area. *Acta Bot. Fennica* **84**: 1–52.

SALISBURY, E. (1961). *Weeds and aliens*. London.

SCANNELL, M. J. P. & SYNNOTT, D. M. (1987). *Census catalogue of the Irish flora*, 2nd ed. Dublin.

STEWART, O. M. (1987). *Anthyllis vulneraria* L. (Kidney vetch). *B.S.B.I. News* **46**: 12–15.

SUOMINEN, J. (1974). Maantieluiskanurmetuksista ja tulokaskasveista. *Luonnen Tutkija* **78**: 12–18.

WILLIAMS, R. D. (1927). *Red clover investigations*. Bulletin of the Welsh Plant Breeding Station H7. Shrewsbury.

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BEVAN'S BITTERCRESS: THE SMALL, WHITE-FLOWERED VARIANT OF *CARDAMINE* × *FRINGSII* WIRTGEN ALSO PRESENT IN BRITAIN

In April 1989, D.B. discovered a striking, white-flowered *Cardamine* (see Bevan 1990) in a flush at Bentley Priory, Middlesex. The plant was robust, uniform and approximately intermediate between *C. flexuosa* With. and *C. pratensis* L. (Table 1), with which it was growing. However, as the plant had small, white flowers rather than the larger, pale lilac flowers usually expected of the hybrid in Britain (Jones 1975), and as *C. pratensis* is very variable (Lovkvist 1956), a hybrid origin of "Bevan's Bittercress" could not be assumed. Further investigation of the Bentley Priory populations was required.

TABLE 1. MORPHOLOGICAL CHARACTERS OF *CARDAMINE* TAXA FROM BENTLEY PRIORY AND OF THE SYNTHESIZED HYBRID
Measurements are ranges made on fresh material.

	C. flexuosa	Bevan's Bittercress	*C. pratensis*	Synthesized hybrid
Height	to 30 cm	to 45 cm	to c. 30 cm	*
Branching	strong below, weak above	weak below, strong above	simple below, weak above	*
Flowering stems	sparsely hairy below	glabrous	glabrous	glabrous
Upper surface of rosette leaves	hairy	glabrous or sparsely hairy when young	glabrous	glabrous or sparsely hairy when young
Petal colour	blade white, claw whitish	blade white, claw greenish	blade purple, pink or white, claw greenish	blade white, claw greenish
length	2·9–4·2 mm	5·2–7·3 mm	9·1–14·2 mm	5·0–7·0 mm
width	1·1–1·5 mm	1·8–2·8 mm	4·5–8·0 mm	2·0–4·2 mm
Sepal length	1·7–2·2 mm	2·2–2·6 mm	3·3–4·6 mm	2·0–3·0 mm
Mean pollen stainability ± S.D.	60%±6%	0%±0%	62%±9·6%	0%±0%

* Not assessed due to slug damage.

FERTILITY

Pollen viability was investigated using Alexander's Stain. At least 100 pollen grains were counted from six flowers of each *Cardamine* (Table 1). About two-thirds of the pollen grains of *C. flexuosa* and *C. pratensis* took up stain, whilst those of Bevan's Bittercress took up no stain at all. The results suggest that Bevan's Bittercress is pollen-sterile. Note that pollen grains which take up stain are not necessarily viable.

A better test of fertility is to assess seed production, and hence flowers of Bevan's Bittercress were self- and cross-pollinated by hand. Bevan's Bittercress stubbornly refused to set any good seed, even when cross-pollinated with *C. pratensis*. By contrast, seed developed freely in both white- and pink-flowered clones of *C. pratensis* when cross-pollinated. *C. flexuosa* is self-compatible and regularly sets good seed.

CHROMOSOME COUNTS

C. flexuosa has a chromosome number of 2n = 32, and *C. pratensis* has reported aneuploid chromosome numbers ranging from 2n = 16 to 2n = 96; the commonest races in Britain are 2n = c. 56 and 2n = c. 30–32 (Hussein 1955; Dale & Elkington 1974). It was hoped that a chromosome count of Bevan's Bittercress might help clarify its relationships.

Chromosomes were counted in root-tips of *Cardamine* taxa from Bentley Priory, at Leicester University. The chromosome numbers of *C. pratensis* were 2n = 30 (white-flowered clone) and 2n = 32 (pink-flowered clone); that of *C. flexuosa* was 2n = c. 30; and that of Bevan's Bittercress 2n = 32. The results can neither confirm nor rule out a hybrid origin of Bevan's Bittercress.

HYBRIDIZATION EXPERIMENTS

If Bevan's Bittercress arose as a hybrid between local plants of *C. pratensis* and *C. flexuosa*, then it should be possible to synthesize it artificially using the same material. Flowers of *C. flexuosa* were cross-pollinated in bud after removal of the stamens (see Lovkvist 1956) using pollen from white- and pink-flowered clones of *C. pratensis*.

Seed set was erratic and germination even more so. No seed was obtained from crosses with the pink-flowered clone of *C. pratensis*. Seed resulting from pollination with the white-flowered clone gave rise to 21 seedlings, 17 of which were *C. flexuosa* probably resulting from pollen contamination. Two of the remaining four plants flowered in 1990 and were an almost exact match for Bevan's Bittercress morphologically and in pollen fertility (Table 1); they also failed to set seed when pollinated by hand. This is strong evidence in favour of a hybrid origin of Bevan's Bittercress.

CONCLUSIONS

It is concluded that Bevan's Bittercress is *C. flexuosa* × *pratensis* = *C.* × *fringsii* Wirtgen (= *C.* × *haussknechtiana* O. E. Schulz). The name *C.* × *fringsii* Wirtgen (1899) has priority over the more widely known name *C.* × *haussknechtiana* O. E. Schulz (1903) (D. H. Kent, pers. comm. 1991).

Bevan's Bittercress differs from variants of *C.* × *fringsii* previously reported in Britain (cf. Jones 1975), but is almost identical with material from the continent (Schulz 1903). Wirtgen describes the petal colour of *C.* × *fringsii* as lilac (D. H. Kent pers. comm.), whilst Schulz describes it as white. The two colour variants may be derived from different chromosome races of *C. pratensis*.

Specimens have been placed in **herb. T.C.G.R.** and **herb. D.B.**

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REFERENCES

BEVAN, D. (1990). *Cardamine flexuosa* × *pratensis* at Bentley Priory, Middlesex. *London Naturalist* **69**: Frontispiece.

DALE, A. & ELKINGTON, T. T. (1974). Variation within *Cardamine pratensis* in England. *Watsonia* **10**: 1–17.

HUSSEIN, F. (1955). Chromosome races in *Cardamine pratensis* in the British Isles. *Watsonia* **3**: 170–174.

JONES, B. M. G. (1975). *Cardamine* L., in STACE, C. A., ed. *Hybridization and the flora of the British Isles*. London.

LOVKVIST, B. (1956). The *Cardamine pratensis* complex. Outlines of its cytogenetics and taxonomy. *Symb. Bot. Upsal.* **14** (2): 5–131.

SCHULZ, O. E. (1903). Monographie der Gattung *Cardamine*. *Bot. Jahrb.* **32**: 548–549.

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THE STATUS OF *PULICARIA VULGARIS* GAERTNER IN BRITAIN IN 1990

The Small Fleabane, *Pulicaria vulgaris* Gaertner, is an annual plant associated with traditionally grazed village greens. The historic distribution of the plant and its decline through this century, together with various ecological studies have been described by Hare (1990). The Small Fleabane is sufficiently rare to be listed in the *British Red Data Book* (Perring & Farrell 1983) and to receive special protection through inclusion on Schedule 8 of the Wildlife and Countryside Act 1981.

The Small Fleabane in Britain is confined to southern England. The major strongholds lie in the south-west of the Hampshire basin with scattered outlying populations in the south of the Thames basin. The plant is present in the administrative counties of Dorset, Hampshire and Surrey but in the Watsonian vice-counties of S. Hants. (v.c. 11), N. Hants. (v.c. 12) and Surrey (v.c. 17).

In 1990 botanists from the Flora Group of the Hampshire and Isle of Wight Naturalists' Trust undertook a review of the status of the plant in Britain. All the areas where the plant has been known in recent years were visited, or were subject to reports from local botanists. At each site the number of plants was counted where practicable, or estimated where present in large numbers. At most sites the location and distribution of the plants were mapped both on 1:10000 O.S. base maps and on sketch maps.

The notion of a 'site' is not entirely appropriate for this species due to the ruderal nature of the preferred habitat and the consequential erratic distribution of plants within a general area from year to year. For convenience sites were defined on an ad hoc basis around the ease of visiting and mapping populations.

The British population of Small Fleabane in 1990 was estimated to be some 10,000 plants spread over ten sites. Seven of these ten sites lay within the borders of the New Forest. One site lay in the Avon Valley to the immediate west of the Forest. The remaining two sites lay in the Thames basin, one in Hampshire, the other in Surrey.

The seven New Forest sites accounted for about 77% of the British plants. With a notable exception, the Forest sites which supported strong populations were located not on the Crown Lands managed by the Forestry Commission but on the verges and greens of adjacent commons to the north-east and west of the Forest. Additional small populations were found towards the south of the Forest.

The Avon Valley site accounted for about 22% of the British plants. This population was counted as a single site although the plant was found over a wide area within a single farm. The majority of plants were found in a trackway with another colony in a smaller nearby track, and three small populations associated with broken ground within hay fields and a garden fruit cage.

The populations of the Forest, combined with that of the Avon Valley, account for over 99% of the British plants. The smaller New Forest sites and the Thames basin sites supported a total of fewer than 60 plants in 1990.

Amongst the Flora Group visiting various sites were botanists who had known individual populations over a number of years; we also had the benefit of being accompanied by Dr T. Hare. The general impression was that 1990 was a relatively good year for the species with strong

populations in most of the traditional strongholds. The prolonged drought was thought to be responsible for the drier sites supporting reduced populations but the relatively wet sites supported strong populations. The presence of two generations of plants was noted, one probably associated with germination in spring, the other with germination after the brief summer rains. The action of Forest ponies occasionally pulling up plants was observed. It was thought the ponies were seeking to eat the Small Fleabane but, finding it unpalatable, were discarding it. The absence of the Small Fleabane from one of its three recent Thames Basin localities was not considered significant. This year the site was not subject to its usual level of grazing and thus the open, trampled sward preferred by the plant had become overgrown by vigorous grasses. A return to grazing and subsequent open ground should revive the population.

Within the New Forest the 1990 population may be compared to the 1985 population. In 1985 the Nature Conservancy Council co-ordinated a census of rare plants in the New Forest. The population of Small Fleabane in 1985 was estimated to be in excess of 106,000 plants. The dramatic decline in the total numbers to the present 7700 in the Forest can be attributed to the change in management of a common on the north-east of the Forest. In the early 1980s this common was subject to heavy use by commerical vehicles which resulted in gross disturbance to the vegetation and soils. Whilst the ruts associated with this use were advantageous to the Small Fleabane the disturbance was otherwise undesirable. By 1990 this use had ceased and many of the former ruts and hollows had disappeared. The population of Small Fleabane in this locality has fallen from an estimated 100,000 plants in 1985 to an estimated 1200 plants in 1990.

Of the 1985 sites only one area was found to have changed to become unsuitable for the Small Fleabane. This was a length of verge that had been excavated to install underground telecommunications equipment. The reinstatement of the verge was such as to destroy the seasonally inundated hollows preferred by Small Fleabane and to replace them by mounded spoil from adjacent ditches. Another of the 1985 sites has also been adversely modified. This is a small green at a road junction that has been planted with an ornamental tree. Given that the Small Fleabane is intolerant of shade it must be expected that this colony will decline as the tree matures.

The traditional practices of turning livestock out onto Forest commons currently maintains suitable habitats for the species, yet the future of the commoning economy is uncertain (New Forest Review Group 1988). The acceptance of the threat to the surviving populations from the cessation of traditional grazings must form the basis of future conservation efforts (Whitten 1990). The Small Fleabane populations in the New Forest should not be assumed to be secure.

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REFERENCES

Hare, T. (1990). Lesser Fleabane– a plant of seasonal hollows. *British Wildlife* **2**: 77–79.
New Forest Review Group. (1988). *Report of the New Forest Review Group*. Lyndhurst.
Perring, F. H. & Farrell, L. (1983). *British Red Data Book: 1. Vascular Plants*, 2nd ed. Lincoln.
Whitten, A. J. (1990). *Recovery: A proposed programme for Britain's protected species*. Nature Conservancy Council, C.S.D. Report No. 1089.

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CAREX × *GAUDINIANA* GUTHNICK – A RARITY?

This hybrid, between *Carex dioica* and *C. echinata*, is known in a number of central and northern European countries but has only twice been reported from Britain and Ireland. The first discovery

was in 1942 by A. W. Stelfox in a bog near Louisburgh in West Mayo (specimens in **BM** and **K**); in 1970 a second site for it was found by I. R. Bonner in Denbighshire. In 1989 Mrs J. A. Green, the present recorder for Denbighshire, who had been trying to establish the locality for this sedge and assess the size of the population, sent specimens to the Natural History Museum for confirmation. These, however, proved inconclusive, and in 1990 Mrs Green invited me to join a party to survey the site, the North Wales Wildlife Trust's Reserve at Gors Maen Llwyd.

Both the reputed parents of *C.* × *gaudiniana* Guthnick were locally abundant in the Reserve, but at first we were confused by what came to be known as "funny *echinata*", a form of that species with the male florets at the base of the terminal spike extending into a recognisable male spike which might be as much as a centimetre long. I had never consciously noted this character before in *C. echinata*, and a later examination of the specimens in **BM** suggested that in Britain it is of rare occurrence. Yet the monographer of *Carex*, Kükenthal (1909), evidently regarded it as the norm for *C. echinata*, for his description (of "*Carex stellulata*") includes the phrase "spiculae 3–5 gynaecandrae, terminalis basi in partem ♂ longe attenuata".

When we at last came upon *C.* × *gaudiniana*, whose very distinct appearance was checked against the precise, if somewhat convoluted, description in Ascherson & Graebner (1904) and perfectly accorded with it, there could be no doubt about our having found the right thing. The true plant forms tight clumps, some 15 cm across, of upright narrow leaves well surmounted by the rigidly erect flowering stems. These resemble tiny tridents, for the terminal male spike, a narrow cylinder up to 12 mm long, is flanked on either side by short, divergent female spikes. Another characteristic is that the male spike frequently has odd female florets embedded in its apex or at points below.

Some dozen plants were spotted in a wet grassy area c. 10 m square and ringed by *Calluna vulgaris* near the middle of the western half of the bog. A pair and a single were seen at two spots in the eastern half. In all three places the hybrid was accompanied by both parents. It is hard to believe that it does not occur elsewhere in Britain and Ireland where *C. dioica* and *C. echinata* are found together, and a look-out should be kept for it.

REFERENCES

Ascherson, P. & Graebner, P. (1904). *Synopsis der mitteleuropäischen Flora*, Band 2: 232–233. Leipzig.

Kükenthal, G. (1909). Cyperaceae-Caricoideae, in Engler, H. G. A. *Das Pflanzenreich*, **38 (IV.20)**: 228–230. Leipzig.

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THE STATUS OF *OENOTHERA CAMBRICA* ROSTAŃSKI AND *O. NOVAE-SCOTIAE* GATES (ONAGRACEAE)

In 1977 K. Rostański described *Oenothera cambrica* from Pembrey in South Wales, United Kingdom. According to Rostański (1982; Rostański & Ellis 1979) this entity is confined to "Wales, Jersey and southern England", occurring there in "sand-dunes, sandy sea-shores, railway banks and waste places". Work during the past decade towards a thorough revision of *Oenothera* subsect. *Oenothera* has resulted in the reduction of *O. cambrica* to the complex synonymy of *Oenothera biennis* L. This detailed revision of the entire subsection *Oenothera* is in final preparation for publication in 1991 by W. Dietrich, W. L. Wagner and P. Raven. It supports and amplifies the philosophy that was described by Raven *et al.* (1979). This taxonomy provides a classification basically consistent with those applied to other groups of plants, and especially with the other sections of *Oenothera*. The comprehensive work underway for over the past decade has resulted in a classification in which five out-crossing, bivalent-forming species, and eight, essentially clonal, permanent translocation heterozygote species are recognized. In this treatment the permanent translocation heterozygote species are treated rather broadly. They behave essentially like other clonal species, although the mechanism, involving chromosomal translocations, balanced lethals, and self-pollination, is anomalous (for summary see Cleland 1972; Holsinger & Ellstrand 1984).

Each of these entities is comprised of a few to numerous true-breeding phenotypes that share common genetic and certain related phenotypic characteristics. *Oenothera biennis* is the most polymorphic and widespread of the eight permanent translocation heterozygote species of subsection *Oenothera* and consists of a large number of minor phenotypes, of which *O. cambrica* is one that originated from naturalized populations of *O. biennis* from North America.

Rostański (1985), after examining a specimen in **BM** annotated by R. R. Gates as *Oenothera novae-scotiae* Gates (Cult. at Regent's Park, London, *Gates 51/35*), decided that his earlier described *O. cambrica* represented the same entity as this specimen. He therefore adopted *O. novae-scotiae* for these plants. Rostański, however, did not examine the type of *O. novae-scotiae* from Nova Scotia, Canada (*Gates s.n.*, UC–193440, holotype) indicated in the original publication by Gates (1918). I have examined the holotype and it does not represent *O. cambrica* (= *O. biennis*), but rather a quite distinct North American species with subterminal sepal-tips, *O. parviflora*, which is also naturalized in Europe. *Oenothera parviflora* is known in Great Britain from scattered collections in and near Glamorgan, Wales (Rostański 1982).

Thus, the names *O. cambrica* and *O. novae-scotiae* should not be placed together. *Oenothera cambrica* represents a phenotype of *O. biennis* with red pustulate-based hairs, a trait that is widely variable in the indigenous range of this species. *Oenothera novae-scotiae* represents *O. parviflora*. European workers who have not adopted the taxonomic philosophy discussed above for subsect. *Oenothera* should refer to the plants with small flowers, terminal sepal-tips and red pustulate-based hairs from Great Britain as *Oenothera cambrica*.

REFERENCES

Cleland, R. (1972). Oenothera *cytogenetics and evolution*. London.

Gates, R. R. (1918). A new evening primrose. *Oenothera novae-scotiae*. *Trans. Nova Scotia lit. Soc.* **14**: 141–145.

Holsinger, K. E. & Ellstrand, N. C. (1984). The evolution and ecology of permanent translocation heterozygotes. *Am. Nat.* **124**: 48–71.

Raven, P. H., Dietrich, W. & Stubbe, W. (1979). An outline of the systematics of *Oenothera* subsect. *Euoenothera* (Onagraceae). *Syst. Bot.* **4**: 242–252.

Rostański, K. (1977). Some new taxa in the genus *Oenothera* L. subgenus *Oenothera*. Part III. *Fragm. flor. geobot.* **23**: 285–293.

Rostański, K. (1982). The species of *Oenothera* L. in Britain. *Watsonia* **14**: 1–34.

Rostański, K. (1985). Zur Gliederung der Subsektion *Oenothera* (Sektion *Oenothera*, *Oenothera* L., Onagraceae). *Feddes Repert.* **96**: 3–14.

Rostański, K. & Ellis, G. (1979). Evening Primroses (*Oenothera* L.) in Wales. *Nature Wales* **16**: 238–249.

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A NEW VARIANT OF *OPHRYS APIFERA* HUDSON IN BRITAIN

On 20 June 1990, during a visit to Oxwich Burrows N.N.R. in Glamorgan, v.c. 41, I found a group of abnormal Bee Orchids (*Ophrys apifera* Hudson) in the dune slacks. This group included ten abnormal and four normal plants growing in an isolated slack.

The abnormal plants were all robust, about 310 mm tall, with an inflorescence 200 mm in length containing about ten florets. Most were fully expanded, about two were in bud and a further one had failed to develop. There were three sheathing stem leaves, and the lowest bract measured 45 mm in length. All the perianth segments were entire, pink in colour with a strongly marked green central vein and two or more paramedian veins. The three inner perianth segments were slightly crinkled, but otherwise resembled the outer perianth segments (Fig. 1). Measurements of length and maximum width of the segments of a specimen floret were as follows: dorsal outer segment 16 × 8·5 mm, lateral outer segments 16·5 × 8 mm and 16·5 × 7·5 mm; ventral inner segment 15·5 × 8·5 mm, lateral inner segments 16 × 7·5 mm. The column appeared normal, with well developed pollinia and evidence of self pollination. There is a high frequency of autogamy in *Ophrys apifera*, which enables

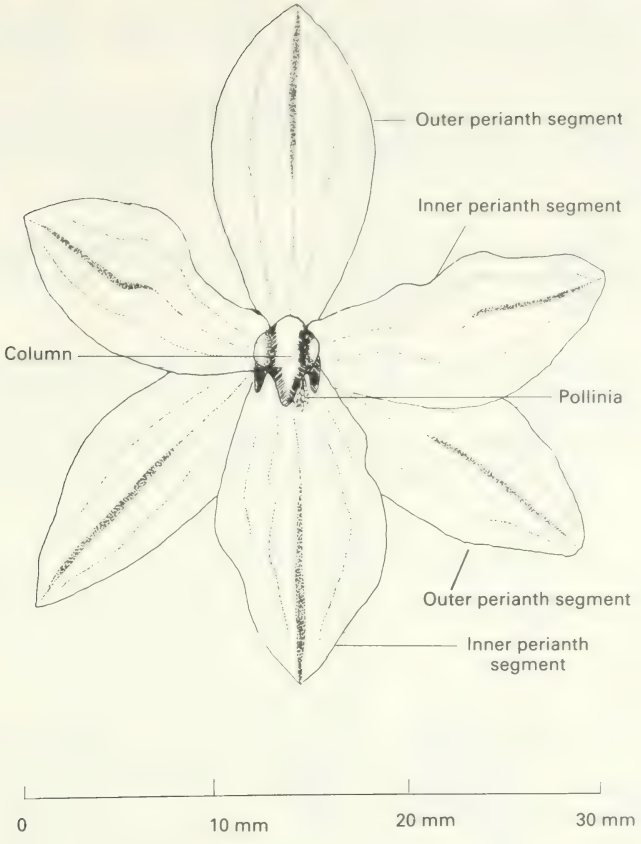

FIGURE 1. Abnormal *Ophrys apifera* from Oxwich Burrows.

morphological variants arising through mutation to persist, and sometimes predominate, in certain areas.

In his paper on peloria and pseudopeloria, Bateman (1985) identified two categories of peloria: type (a) in which the lateral inner perianth segments are replaced by additional well differentiated labella; and type (b) in which the labellum is replaced by a third, undifferentiated, inner perianth segment. Clearly the peloria demonstrated by the Oxwich plants is not of either category, but comes close to that described by Horsman (1990) for *Orchis latifolia* L. Horsman proposed a new category, which he called type (c) peloria, where all the perianth segments are identical. The perianth segments of the Oxwich plants are not identical, and form an inner and outer series of three each. The inner segments are morphologically similar, but have no resemblance to either the labellum or the lateral inner perianth segments of normal *O. apifera*. The Oxwich plants probably merit a subdivision of Horsman's type (c) peloria. The literature describes four abnormal kinds of *O. apifera* which have been given subspecific or varietal status. It would be more consistent to treat these as having equal rank, preferably using varietal names.

Var. **botteronii** Chodat (syn. subsp. *jurana* Ruppert, var. *friburgensis* Freh.). The two lateral petals resemble pink sepals, with finely hairy margins. Labellar speculum bears two confluent yellow areas. First described in Britain in 1984 in Wiltshire (Laurence 1986). Illustrated by Duperrex (1961), Baumann & Künkele (1982), Davies *et al.* (1983) and Lang (1989).

Var. **bicolor** (Naegli) Nelson. The base of the labellum is greenish, lacking any pattern, rest of labellum dark brown. Recorded from Anglesey by Roberts (1985). Illustrated by Baumann & Künkele (1982) and Davies *et al.* (1983).

Var. **flavescens** Rost (syn. var. *chlorantha* (Hegetschw.) Richter, var. *immaculata* Breb.). Sepals white, labellum lacking basal red brown pigmentation, appearing sage green. Widespread. Locally frequent in E. Suffolk and E. Sussex. Illustrated by Lang (1980), Baumann & Künkele (1982) and Davies *et al.* (1983).

Var. **trollii** (Hegetschw.) Reichenbach. Labellum long and pointed, often barred brown and yellow. Long known from Gloucestershire, Dorset and several other localities. Illustrated by Summerhayes (1951), Lang (1980) and Baumann & Künkele (1982).

In addition, a pseudopeloric variant, in which the labellum is replaced by a pink sepaloid segment, was first recorded in E. Sussex in 1924 by C. B. Tahourdin. Illustrated by Tahourdin (1924), Wolley-Dod (1937) and Lang (1980).

None of the above corresponds to the Oxwich plants. However, F. Horsman (pers. comm) informs me that Camus & Camus (1929) recorded a similar variant from mainland Europe.

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REFERENCES

Bateman, R. M. (1985). Peloria and pseudopeloria in British orchids. *Watsonia* **15**: 357–359.
Baumann, H. & Künkele, S. (1982). *Die wildwachsenden Orchideen Europas*. Stuttgart.
Baumann, H. & Künkele, S. (1986). Die Gattung *Ophrys* L. – eine taxonomische Ubersicht. *Mitt. Bl. Arbeitskr. Heim. Orch. Baden-Wurtt.* **18**: 320–323.
Camus, E. G. & Camus, A. (1929). *Iconographie des Orchidées d'Europe et du Bassin Méditerranéen* **2**, p. 325. Paris.
Davies, P., Davies, J. & Huxley, A. (1983). *Wild orchids of Britain and Europe*. London.
Duperrex, A. (1961). *Orchids of Europe*. Blandford.
Horsman, F. (1990). Peloria in *Dactylorhiza*. *B.S.B.I. News* **55**: 16–18.
Lang, D. C. (1980). *Orchids of Britain*. Oxford.
Lang, D. C. (1989). *A guide to the wild orchids of Great Britain and Ireland*, 2nd ed. Oxford.
Laurence, R. J. (1986). *Ophrys apifera* Hudson subsp. *jurana* Ruppert found in Britain. *Watsonia* **16**: 177–8.
Roberts, R. H. (1985). Some unusual orchid variants from Anglesey. *Watsonia* **15**: 275–277.
Summerhayes, V. S. (1951). *Wild orchids of Britain*. London.
Tahourdin, C. B. (1924). *Some notes as to British Orchids*. Croydon.
Wolley-Dod, A. H. (1937). *Flora of Sussex*. Hastings.

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SALIX × *SEMINIGRICANS* A. & G. CAMUS: A WILLOW HYBRID NEW TO THE BRITISH ISLES

On 19 July 1985, as part of a *Salix* course at Kindrogan Field Centre, Perthshire, a visit was made to the River Tay, near Meikleour. On the west bank of the river, immediately north of Kinclaven Castle, three willow bushes were seen on either side of the bridge that crosses the Tay at this point. Of the two growing north of the bridge one was fully grown, about 9 m tall, with a trunk about 15 cm diam. leaning out over the river; the second was smaller and less mature, and the third, to the south of the bridge, was clearly juvenile, erect, about 2 m tall, and had almost certainly arisen vegetatively

FIGURE 1. *Salix* × *seminigricans* A. & G. Camus
A: leaves; B: stipules; C: catkins; D: ♀ flower; E: tip of flowering shoot.
Scale bar = 1 cm (A, C, E) or 0·6 mm (B, D).

from a broken-off branch carried downstream from the largest bush. The three were morphologically indistinguishable.

At first sight it was clear that the willow was a *viminalis*-hybrid: it had the acuminate leaves characteristic of such hybrids; but the relatively sparse indumentum on the underside of the leaves, the subglabrous, greenish shoots, and the small, poorly developed stipules ruled out the more usual *viminalis*-hybrids, namely *S.* × *smithiana* Willd. (*S. cinerea* L. × *S. viminalis* L.) and *S.* × *sericans*

Tausch ex Kerner (*S. caprea* L. × *S. viminalis* L.), and suggested that it was much more likely to be *S. myrsinifolia* Salisb. × *S. viminalis* L. (*S.* × *seminigricans* A. et G. Camus), a hybrid not previously recorded for the British Isles, and evidently rare on the Continent. *Salix myrsinifolia* was plentiful in the area, and *S. viminalis* was seen on the banks of the R. Isla nearby.

No catkins were available at the time of the visit, and, without these, a final decision on the identity of the willow could not be made. Fortunately Mr Jeremy Heath (of Colchester and Essex Museum) had, at some personal risk, climbed out over the river, and had obtained good specimens from the largest bush, which, on his return to Colchester, he successfully rooted and cultivated, so that, by the spring of 1990, he was able to supply me with excellent flowering material. The catkins confirm my earlier, tentative identification. I am satisfied that the hybrid is *S. myrsinifolia* × *S. viminalis*, and since it may be found elsewhere in Scotland or northern England, a full description and illustration (Fig. 1) may be useful.

Salix × **seminigricans** A. & G. Camus, *Class. Saules d'Europe* **2**: 130 (1905).
S. nigricans Sm. × *S. viminalis* L.; Schmalh. in *Bot. Zeit.* **33**:574 (1875); Trautv., *Increm. Fl. Phaenog. Ross.* **3**:698 (1883); Guerke, *Pl. Europ.* **2**:27 (1897).
S. myrsinifolia Salisb. × *S. viminalis* L.
Type: U.S.S.R., near Leningrad, *Schmalhausen (?***KW**, **LE**, **P**)

Spreading shrub or small tree to about 9 m high; twigs glabrous, rather lustrous olive-brown; buds brown, glabrescent; current year's shoots greenish, subglabrous. Leaves lanceolate, acuminate, 5–15 ×1·3–3 cm, rather glossy mid-green above (blackening slightly when dried), greyish and thinly adpressed-pubescent below, nervation distinctly impressed above, midrib and lateral nerves prominent below, margins indistinctly undulate-crisped, entire or subentire; petiole to 1·5 cm long; thinly pubescent; stipules developed only on vigorous growths, small, acute or acuminate, usually less than 3 mm long, submembranous, thinly pubescent, margins glandular. Female catkins appearing in March before the leaves, rather crowded towards the tips of the branches, sessile or subsessile, erect or spreading, cylindrical, blunt, 2–3 cm long, 0·7–0·8 cm diam.; bracts sericeous, lanceolate, rather inconspicuous, usually less than 1 cm long; flowers crowded; catkin-scales ovate, obtuse or shortly acute, about 2 mm long, 0·8–1 mm wide, fuscous on the upper half, rather densely sericeous; nectary solitary, oblong, about 0·2 mm long, shorter than the pubescent pedicel; ovary narrowly ovoid, tapering to apex, about 2–2·5 mm long, 0·7 mm wide, closely adpressed-sericeous; style distinct, about 0·5 mm long; stigmas cleft almost to the base into 4 filiform arms about 1 mm long. Male flowers not seen.

Scotland: Mid-Perth (v.c. 88), west bank of R. Tay immediately north and south of the bridge at Kinclaven Castle; leaves collected 19 July 1985, *J. J. Heath & R. D. Meikle* s.n.; flowers from plants cultivated at Colchester by *J. J. Heath*, comm. 6 March 1990.

Europe: U.S.S.R., Leningrad area.

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THE TYPIFICATION OF *RANUNCULUS BACHII* WIRTG.

In June 1844, the Prussian botanist Philipp Wirtgen discovered some unusual stands of Batrachian *Ranunculi* in the River Sayn and adjacent mill-races between Sayn and Isenburg, near Koblenz. He provisionally named these plants *Ranunculus bachii* (Wirtgen 1845), subsequently described them as *Batrachium bachii* (Wirtgen 1846a) and, later in the same year, provided the combination *Ranunculus bachii* (Wirtgen 1846b).

Wirtgen's herbarium is at Munster (**MSTR**) and he took his Dr. phil. at Bonn (**BONN**). We have borrowed Wirtgen material of this locality from both of these herbaria. It can be divided into two kinds, one of which has no floating leaves and small flowers, the other a different habit, floating leaves and larger flowers. The former fits Wirtgen's original description and that of Webster (1990) and we select one of the sheets of this kind, "*Ranunculus fluitans β bachii* Wtg. In der Sayn bis Isenburg, lgt. com. Wirtgen" (**MSTR**) as the lectotype of *Batrachium bachii* Wirtgen. It is

morphologically intermediate between *R. fluitans* and *R. trichophyllus*. The other kind seems to be indistinguishable from *R.* × *kelchoensis* S. Webster (1990) (*R. fluitans* × *peltatus*).

There is a possible problem with these hybrids. We do not know what range of morphology would be shown by the hybrid *R. aquatilis* × *fluitans*. Cook (1966, 1975) says that some forms of this hybrid are indistinguishable from, and comprise part of *R.* × *bachii*. On the other hand if they had floating leaves they might be indistinguishable from *R.* × *kelchoensis*. The sensible thing to do is to put all plants into these two taxa, using binomials, until such time as a *R. aquatilis* × *fluitans* can be morphologically recognised.

REFERENCES

Cook, C. D. K. (1966). A monographic study of *Ranunculus* subgenus *Batrachium* (DC.) A. Gray. *Mitt. bot. StSamml., Münch.* **6**: 57–237.
Cook, C. D. K. (1970). Hybridization in the evolution of *Batrachium*. *Taxon* **19**: 161–166.
Webster, S. D. (1990). Three natural hybrids in *Ranunculus* L. subgenus *Batrachium* (DC.) A. Gray. *Watsonia* **18**: 139–146.
Wirtgen, P. [W.] (1845). Zweiter Nachtrag zur Flora preuss. Rheinlande. *Verh. naturh. Ver. preuss. Rheinl.* **2**: 22–32.
Wirtgen, P. [W.] (1846a). *Batrachium bachii* Wirtg.: eine neue Pflanzenspecies. *Verh. naturh. Ver. preuss. Rheinl.* **3**: 8–10.
Wirtgen, P. [W.] (1846b). Dritter Nachtrag zu dem Prodromus der Flora der preuss. Rheinlande. *Verh. naturh. Ver. preuss. Rheinl.* **3**: 33–45.

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THREE NEW GRASS COMBINATIONS

Three names of grasses used in *New Flora of the British Isles* (Stace 1991) have not been validly published before now. They are new combinations necessitated by the adoption of the generic circumscriptions in *Genera Graminum* (Clayton & Renvoize 1986). All three are casuals on tips and waste ground, the first two occasional, the last rare.

1. **Helictotrichon neesii** (Steudel) Stace, **comb. nov.**
Amphibromus neesii Steudel, *Syn. Fl. Glum.* **1**: 328 (1854)

2. **Ceratochloa staminea** (E. Desv.) Stace, **comb. nov.**
Bromus stamineus E. Desv. in C. Gay, *Fl. Chil.* **6**: 440 (1854)
Bromus valdivianus Philippi in *Linnaea* **29**: 101 (1857)

3. **Leptochloa muelleri** (Benth.) Stace, **comb. nov.**
Diplachne muelleri Benth., *Fl. Austral.* **7**: 619 (1878)

REFERENCES

Clayton, W. D. & Renvoize, S. A. (1986). *Genera Graminum*. London.
Stace, C. A. (1991). *New Flora of the British Isles*. London.

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FESTUCA ARUNDINACEA SCHREB. VAR. *STRICTIOR* (HACK.) K. RICHT.

Hackel (1882) was the author of *F. arundinacea* Schreb. subvar. *strictior* which was raised to a variety by K. Richter. A taxon of the description given by Hackel (1882) can be recognised in the field but is seldom found as an isolated plant and is more often seen within large or small colonies of *F. arundinacea*. This taxon has not been widely accepted and few records exist.

Hackel (1882) described subvar. *strictior* with "leaf blades narrower (3–5 mm broad) and shorter (than *F. arundinacea*), stiff becoming sub-convolute on drying . . . panicle shorter (up to 15 cm long), strict, scarcely nodding . . . spikelets as of *F. arundinacea*". Having examined a considerable number of small specimens of *F. arundinacea*, I concluded that var. *strictior* could be more fully described as follows: height 50–90 cm, panicle length 6–15 cm, upper cauline blade (1·5–) 4–10 cm × 1–3·5 mm, spikelet 8–10 mm, lemma (5·5–) 6–8 mm.

Druce (1931) collected the plant at Budleigh Salterton, S. Devon (v.c. 3) and Townsend (1953) collected it from "a marshy field" near Barbers Bridge station, W. Gloucs. (v.c. 34); both collections were determined by Howarth. Kent (1975) recorded subvar. *strictior* from Hounslow Heath, Middlesex (v.c. 21) in the late "forties" in the company of C. E. Hubbard, who at the time treated it as a subvariety of no importance. This taxon was not listed in Hubbard (1954). Webster (1978) returned var. *strictior* to modern recognition with a site on the banks of the R. Spey at Dandaleith, Moray (v.c. 95), 1974, **E** and on newly sown verges at Cluanie Dam in Glen Moriston, Easterness (v.c. 96), 1974, **E**; both of these records were determined by C. E. Hubbard.

In Cambs. (v.c. 29) *F. arundinacea* demonstrates its preference for calcareous clay. With Balsham as a centre, it is seen on the road verges to the south of Woodhall Farm, along the Balsham-Linton road. Large colonies are found at intervals along the B1052 in a north-easterly direction as far as Dullingham and east to Kirtling. The soil of this area is a chalky boulder clay of the Hanslope series over a chalky till. The soil survey of England & Wales (1983) describes it as slowly permeable calcareous clayey soil. Most of the soil samples would be pH 7·5–8·0. It is heavy land and its road verges have been subject to much over-riding of farm machinery and other wheeled traffic, which has compacted the soil to cause impeded drainage and allow for a high level of moisture retention.

F. arundinacea is almost absent from the soils of the Middle Chalk in Cambs. (v.c. 29). In a survey of road verges from the south of Thriplow on the A505, east to Babraham, over The Gog and Magog Hills to the Beech Woods and down to Fulbourn, only three plants of var. *strictior* were seen in isolation, just west of Duxford and two plants near Pampisford Hall.

Plants corresponding to var. *strictior* are found on the boulder clay in Cambridgeshire, in association with the typical variety. They are seldom seen in isolation, as quoted above at Duxford and Pampisford, but as a single culm within a clump or on the open margin of a colony in which it is frequently over-shadowed by the taller culms of typical *F. arundinacea*. The smaller variant is also found near the margin of road verges and a closer look sometimes reveals that the plant has been damaged by traffic running over the verge. Within any colony of *F. arundinacea* of 50–80 flowering stems, there are plants with short, narrow upper cauline blades of 4–10 cm long and short strict panicles, which may have a culm length of over 150 cm. Equally short panicles of 6–15 cm long are found with upper cauline blades of over 40 cm long. In large colonies, tall stem-growth inevitably over shadows weak stem-growth and var. *strictior* becomes stunted. It seems clear that a random selection of short-stemmed plants will not necessarily have short panicles and/or short upper cauline blades. It is considered that Hackel's taxonomic recognition of this variant of *Festuca arundinacea* is inappropriate and that those small plants with short, strict panicles and short upper cauline blades should only be considered as environmentally-induced variants.

ACKNOWLEDGMENT

I thank Dick David for his help in the translation of Hackel's description of subvar. *strictior*.

REFERENCES

Druce, G. C. (1931). Plant record. *Rep. botl. Soc. Exch. Club Br. Isl.* **9**: 678.
Hackel, E. (1882). *Monographia Festucarum Europaearum*, p. 154. Berlin.

HUBBARD, C. E. (1954). *Grasses*, p. 145. Harmondsworth.
KENT, D. H. (1975). *Historical Flora of Middlesex*, p. 566. London.
SOIL SURVEY OF ENGLAND & WALES (1983). Sheet 4, eastern England.
TOWNSEND, C. C. (1953). Plant record. *Watsonia* **2**: 356.
WEBSTER, M.McC. (1978). *Flora of Moray, Nairn and East Inverness-shire*, p. 147. Aberdeen.

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CONTRIBUTIONS TO A CYTOLOGICAL CATALOGUE OF THE BRITISH AND IRISH FLORA, 1

A cytological catalogue of the British and Irish flora is being prepared (funded in part by a grant from the Welch Bequest), which will collate details of all published and unpublished chromosome counts made on indigenous material of native species (Gornall 1989). As only about 62% of the flora have properly documented counts, much original work still needs to be done; this is being conducted at three centres: the Botany Department, Leicester University; the Scottish Crop Research Institute, Invergowrie; and Trinity College, Dublin. The present paper is the first in a new series which will report the results of our studies as they progress. The chromosome counts of 61 species and their provenances are presented here. Figures in parentheses after the locality details indicate the number of plants counted. All counts were made from squashes of root-tips; supernumerary chromosomes are designated by the suffix 'S'. Voucher specimens have been placed in **LTR**.

Ammophila arenaria (L.) Link, 2n = 28: S. Lancs., v.c. 59, Ainsdale, 34/2.1 (3).
Anthriscus sylvestris (L.) Hoffm., 2n = 16: W. Cornwall, v.c. 1, Buryas Bridge, 10/44.29 (1).
Arctium minus Bernh., 2n = 36: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Atropa bella-donna L., 2n = 72: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Blackstonia perfoliata (L.) Hudson, 2n = 40: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Callitriche brutia Petagna, 2n = 28: Caerns., v.c. 49, W. of Rhydlios, Methlem Farm, 23/174.301 (1).
C. platycarpa Kutz., 2n = 20: Caerns., v.c. 49, N. of Llangwnnadl, Traeth Penllech, 23/20.34 (3).
Campanula trachelium L., 2n = 34: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Carduus acanthoides L., 2n = 16: Derbys., v.c. 57, Milldale, 43/14.55 (1).
Centaurea nigra L., 2n = 44: W. Norfolk, v.c. 28, Fouldon Common, 52/761.997 (3).
Chamaemelum nobile (L.) All., 2n = 18: Caerns., v.c. 49, SW. of Abersoch, S. of Mynydd Cilan, 23/292.240 (1).
Clematis vitalba L., 2n = 16: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (1).
Cynodon dactylon (L.) Pers., 2n = 36: S. Somerset, v.c. 5, Warren Point, Minehead, 21/986.463 (1); N. Somerset, v.c. 6, Weston-super-Mare, 31/317.603 (1); S. Essex, v.c. 18, Southend, Shoeburyness, 51/448.852 (1). (No vouchers.)
Digitalis purpurea L., 2n = 56: Caerns., v.c. 49, Llaniestyn, near Penbodlas, 23/281.337 (2).
Erodium cicutarium (L.) L'Herit. subsp. *cicutarium*, 2n = 40: Derbys., v.c. 57, Dovedale, 43/14.52 (1).
Euonymus europaeus L., 2n = 32: Surrey, v.c. 17, Old Coulsdon, hillside above Old Lodge Lane, 51/31.59 (1); Caerns., v.c. 49, near Aberdaron, by the Afon Saint, 23/166.265 (1).
Filipendula ulmaria (L.) Maxim., 2n = 16: Derbys., v.c. 57, Dovedale, 43/14.51 (1).
Fragaria vesca L., 2n = 14: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (3).
Frankenia laevis L., 2n = 30: W. Sussex, v.c. 13, East Wittering, 40/80.97 (1).

Galium aparine L., 2n = 66: Caerns., v.c. 49, E. of Sarn, 23/24.32 (1).
G. mollugo L., 2n = 44: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Geum urbanum L., 2n = 42: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (1).
Hypericum hirsutum L., 2n = 18: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (2); Derbys., v.c. 57, Dovedale, 43/14.51 (1).
H. humifusum L., 2n = 16: W. Cornwall, v.c. 1, Goonhilly 10/73.21 (1).
Inula conyza DC., 2n = 32: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Iris foetidissima L., 2n = 40: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (1).
Lepidium heterophyllum Bentham, 2n = 16: Caerns., v.c. 49, near Aberdaron, overlooking Afon Saint, 23/16.26 (1).
Leymus arenarius (L.) Hochst., 2n = 56 + 3S: S. Lancs., v.c. 59, Ainsdale, 34/2.1 (3).
Lycopus europaeus L., 2n = 22: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (3).
Lysimachia nemorum L., 2n = 18: Caerns., v.c. 49, Nanhoron valley, S. of Inkermann Bridge, 23/28.32 (3).
Medicago arabica (L.) Hudson, 2n = 16: Caerns., v.c. 49, Aberdaron, 23/172.264 (1).
Mercurialis perennis L., 2n = 64: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (1); Derbys., v.c. 57, Dovedale, 43/14.51 (1).
Montia perfoliata (Willd.) Howell, 2n = 36: Leics., v.c. 55, Leicester, university campus, 43/59.04 (1).
Myosotis sylvatica Hoffm., 2n = 18: Caerns., v.c. 49, Llaniestyn, near Penbodlas, 23/281.337 (1).
Ononis spinosa L., 2n = 30: W. Norfolk, v.c. 28, Foulden Common, 52/761.997 (3).
Origanum vulgare L., 2n = 30: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (2); Derbys., v.c. 57, Dovedale, 43/14.51 (1).
Pastinaca sativa L., 2n = 22: N. Hants., v.c. 12, near Petersfield, W. of Shoulder of Mutton, above Steep, 41/73.26 (2).
Pilularia globulifera L., 2n = 26: Caerns., v.c. 49, S. of Abersoch, Mynydd Cilan, 23/291.241 (1).
Plantago coronopus L., 2n = 10: W. Cornwall, v.c. 1, near St Just, 10/39.31 (1).
P. lanceolata L., 2n = 12: Derbys., v.c. 57, Dovedale, 43/14.52 (3).
P. major L. subsp. *major*, 2n = 12: Derbys., v.c. 57, Milldale, 43/14.54 (3).
P. major subsp. *intermedia* (DC.) Arcangeli, 2n = 12: Leics., v.c. 55, Cropston Reservoir, 43/54.10 (3).
Potentilla sterilis (L.) Garcke, 2n = 28: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (1); Derbys., v.c. 57, Dovedale, 43/14.51 (1).
Primula veris L., 2n = 22: Derbys., v.c. 57, Milldale, 43/14.55 (3).
P. vulgaris Huds., 2n = 22: Caerns., v.c. 49, Llanbedrog, W. of Penarwel, 23/328.324 (1).
Ranunculus repens L., 2n = 32: Caerns., v.c. 49, Llaniestyn, near Penbodlas, Llys Hyfryd, 23/28.33 (1).
Rumex obtusifolius L., 2n = 40: Derbys., v.c. 57, Milldale, 43/14.54 (1).
Sanguisorba minor Scop., 2n = 28: Derbys., v.c. 57, Dovedale, 43/14.52 (1).
Sanguisorba officinalis L., 2n = 56: Leics., v.c. 55, Broughton Astley, 42/53.94 (3).
Saxifraga hypnoides L., 2n = 52: Derbys., v.c. 57, Milldale, 43/14.55 (3).
Sherardia arvensis L., 2n = 22: Derbys., v.c. 57, Dovedale, 43/14.52 (1).
Sibthorpia europaea L., 2n = 18: S. Devon, v.c. 3, Dartmoor, north of Holne, Newbridge, 20/712.709 (1).
Silaum silaus (L.) Schinz & Thell., 2n = 22 + 0–1S: W. Norfolk, v.c. 28, Foulden Common, 52/761.997 (3).
Teucrium scorodonia L., 2n = 34: Derbys., v.c. 57, Dovedale, 43/14.51 (1).
Tragopogon porrifolius L., 2n = 12: Co. Durham, v.c. 66, Crimdon to Blackhall, 45/47.38 (1).
Umbilicus rupestris (Salisb.) Dandy, 2n = 48: Caerns., v.c. 49, Llaniestyn, near Penbodlas, 23/28.33 (1).
Urtica dioica L., 2n = 52: Derbys., v.c. 57, Dovedale, 43/14.52 (1).
Verbascum thapsus L., 2n = 36: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (1).
Veronica beccabunga L., 2n = 18: Derbys., v.c. 57, Milldale, River Dove, 43/14.55 (3).

Viburnum lantana L., 2n = 18: Surrey, v.c. 17, Old Coulsdon, hillside above Old Lodge Lane, 51/31.59 (1).

Viola reichenbachiana Jord. ex Boreau, 2n = 20: Dorset, v.c. 9, Wareham, Washer's Pit, 30/86.94 (1).

REFERENCE

GORNALL, R. J. (1989). A proposed cytological catalogue of the British and Irish flora. *B.S.B.I. News* **51**: 34.

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Plant Records

Records for publication must be submitted to the appropriate Vice-county Recorder (see *B.S.B.I. Year Book for 1991*), and *not* the Editors. The record must normally be of species, hybrids or subspecies of native or naturalized alien plants belonging to one or more of the following categories: 1st or 2nd v.c. record; 1st post-1930 v.c. record; only extant v.c. locality, or 2nd such locality; a record of an extension of range by more than 100 km. Such records will also be accepted for the major islands in v.cc. 102–104 and 110. Only 1st records can normally be accepted for *Rubus*, *Hieracium* and hybrids. Records for subdivisions of vice-counties will not be treated separately; they must therefore be records for the vice-county as a whole. Records of *Taraxacum* are now being dealt with separately, by Dr A. J. Richards, and will be published at a later date.

Records are arranged in the order given in the *List of British vascular plants* by J. E. Dandy (1958) and his subsequent revision (*Watsonia*, **7**: 157–178 (1969)). All records are field records unless otherwise stated. With the exception of collectors' initials, herbarium abbreviations are those used in *British and Irish herbaria* by D. H. Kent & D. E. Allen (1984).

Records from the following vice-counties are included in the text below: 1, 2, 4–6, 11, 12, 21, 24–29, 33–35, 38, 39, 41–43, 45–47, 49–54, 61, 62, 64, 67–70, 72, 73, 75–77, 79–81, 83, 87–90, 92–99, 103, 105, 109, 110, H30.

The following signs are used:

* before the record: to indicate a new vice-county record.

† before the species number: to indicate that the plant is not a native species of the British Isles.

† before the record: to indicate a species which, though native in some parts of the British Isles, is not so in the locality recorded.

[] enclosing a previously published record: to indicate that the record should be deleted.

1/5. DIPHASIASTRUM ALPINUM (L.) Holub **81**, Berwicks.: Stony slope, A68 road, Soutra, GR 36/47.56. D. G. Long, 1990. Only extant locality.

3/1. ISOETES LACUSTRIS L. **72**, Dumfriess.: Shallow water, edge of Loch Skeen, GR 36/17.15. O. M. Stewart, 1989. Only extant locality.

4/5 × 6. EQUISETUM FLUVIATILE L. × E. PALUSTRE L. ***73**, Kirkcudbrights.: Marshy rough grassland, Southerness, GR 25/96.54. O. M. Stewart, 1990, **E**, det. C. N. Page.

7/1. HYMENOPHYLLUM TUNBRIGENSE (L.) Sm. **67**, S. Northumb.: N.W.-facing sandstone crags, Roughside Moor, GR 35/73.83. G. A. & M. Swan, 1990, **herb. G.A.S.** 2nd record.

†12/1. ONOCLEA SENSIBILIS L. **12**, N. Hants.: Bank of R. Rother, Liss Forest, GR 41/77.28. J. Ockenden, 1990. 2nd record. ***99**, Dunbarton: Under *Salix* spp. on sandy river bank, R. Leven near Strathleven, GR 26/39.77. K. Futter, 1990, **E**.

15/5 qua. ASPLENIUM TRICHOMANES subsp. QUADRIVALENS D. E. MEYER ***109**, Caithness: Rocky outcrop, Yarrows, GR 39/30.42. J. K. Butler, 1980, **E**, det. C. R. Fraser-Jenkins.

16/1. CETERACH OFFICINARUM DC. ***62**, N. E. Yorks.: Mortar of brick wall, United Reform Church, Loftus, GR 45/71.18. A. M. Fryday, 1988, det. R. L. Gulliver.

21/2 cam. DRYOPTERIS AFFINIS subsp. CAMBRENSIS Fraser-Jenkins **41**, Glam.: Ditch by wood, Cyfarthfa Castle, GR 32/04.07. G. Hutchinson, 1990, **NMW**. 2nd record.

21/2 aff. × 1. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins subsp. AFFINIS × D. FILIX-MAS (L.) Schott ***11**, S. Hants.: Mixed plantation, Spearywell Wood, GR 41/31.27. R. M. Veall, 1989, **herb. R.M.V.**, det. C. R. Fraser-Jenkins.

21/8. DRYOPTERIS AEMULA (Aiton) O. Kuntze **11**, S. Hants.: Streambank in deciduous wood, Howe Copse, Roydon Woods, GR 40/32.99. A. E. Bolton, 1990, **herb. R.P. Bowman**. 2nd record.

24/4. GYMNOCARPIUM DRYOPTERIS (L.) Newman **28**, W. Norfolk: Damp patch in coniferous wood, Weeting, GR 52/80.89. M. Keene, 1990, **NWH**.

25/1/cam. POLYPODIUM CAMBRICUM L. **11**, S. Hants.: Mossy branches of oak, Lyndhurst Hill, Emery Down, GR 41/28.08. D. Winsland, 1989, **herb. R.P. Bowman**, det. R. H. Roberts. 2nd record.

25/1/int. POLYPODIUM INTERJECTUM Shivas *77, Lanarks.: By R. Clyde S. of Lanark, GR 26/8.4. A. McG. Stirling *et al.*, 1989.

25/1/int. × vul. POLYPODIUM INTERJECTUM Shivas × P. VULGARE L. *77, Lanarks.: Rock face, Meikle Dripps, GR 26/58.55. P. Macpherson, 1985, **herb. P.M.**, det. A. McG. Stirling.

40/1/1 × †var. ACONITUM NAPELLUS L. × A. VARIEGATUM L. *49, Caerns.: Ditch, Nanhoron, GR 23/2.3. J. Roberts, 1988, det. C. A. Stace. 2nd Welsh record.

†43/bla. ANEMONE BLANDA Schott & Kotschy *69, Westmorland: Roadside verge between Kentmere and Staveley, GR 35/45.01. C. E. Wild, 1990, **LANC**.

46/19. RANUNCULUS FLUITANS Lam. *4, N. Devon: R. Torridge, Weare Gifford, GR 21/47.21. C. D. Preston & N. F. Stewart, 1989, **CGE**, det. S. D. Webster. 1st confirmed record.

46/22c. RANUNCULUS PENICILLATUS subsp. PSEUDOFLUITANS (Syme) S. Webster *95, Moray: Auchernack Burn 2 km S. of Grantown, GR 38/02.24. J. Edelsten, 1990, **E**, det. S. D. Webster (as var. *pseudofluitans*).

46/23. RANUNCULUS BAUDOTII Godron **29**, Cambs.: Fen ditch, Long Grove, Ouse Fen, GR 52/37.72. A. O. Chater, F. H. Perring & S. M. Walters, 1955, **CGE**, det. S. D. Webster. 1st record since 1859.

48/1. MYOSURUS MINIMUS L. **54**, N. Lincs.: Bare ground near cattle trough, Lea Marshes, GR 43/81.86. A. J. Knibb & R. Nickerson, 1989, det. I. Weston. 1st record since c. 1900.

†51/off. PAEONIA OFFICINALIS L. *69, Westmorland: Roadside, Fell Yeat, Casterton, GR 34/63.79. Woodland by R. Kent, Sedgwick, GR 34/50.86. Both C.E. Wild, 1990, **LANC**. 1st and 2nd records.

57/2. CERATOPHYLLUM SUBMERSUM L. *33, E. Gloucs.: Flooded, disused brick pit, Sandhurst, GR 32/81.23. S. H. Bishop & R. J. Cooper, 1987. Small field pond, Pamington, GR 32/93.31. J. W. Somerset, 1990. 1st and 2nd records.

58/3. PAPAVER LECOQII Lamotte **28**, W. Norfolk: Spring barley field, Feltwell, GR 53/70.90. R. Tofts, 1989. 2nd record. **35**, Mons.: Spoilheaps by R. Usk, Newport, GR 31/32.87. T. G. & U. T. Evans, 1988. 2nd record.

58/5. PAPAVER ARGEMONE L. **50**, Denbs.: Weedy arable field near Fenns Moss, GR 33/50.38. J. A. Green, 1990. 2nd extant locality.

†58/ori. PAPAVER ORIENTALE L. *69, Westmorland: Roadside north of Oxenholme, GR 34/53.91. C. E. Wild, 1988. Between Tebay and Orton, GR 35/62.06. C. E. Wild, 1989. 1st and 2nd records.

66/2. FUMARIA CAPREOLATA L. **11**, S. Hants.: Roadside verge, Southern Lane, New Milton, GR 40/23.94. J. N. Le Rossignol, 1989, **herb. R. P. Bowman**, det. M. G. Daker. Only extant locality.

66/4. FUMARIA BASTARDII Boreau *73, Kircudbrights.: By field, Torrs Moss, GR 25/77.61. O. M. Stewart, 1988, **E**. Field edge, West Maryfield, New Abbey, GR 25/96.66. O. M. Stewart, 1990, **E**. 1st and 2nd records.

†68/1. ERUCASTRUM GALLICUM (Willd.) O. E. Schultz **69**, Westmorland: Roadside south of Black Esset Plantation, Killington, GR 34/58.87. C. E. Wild, 1989, **LANC**. 2nd record.

†71/1. HIRSCHFELDIA INCANA (L.) Lagrèze-Fossat **46**, Cards.: Sandy roadside bank, Penyrergyd, Gwbert, GR 22/16.48. A. O. Chater, 1990. 2nd record. *77, Lanarks.: Waste ground, Springboig, Glasgow, GR 26/65.64. J. H. Dickson & K. Watson, 1989, **GL**. Rough grassland, Cambuslang, GR 26/63.59. K. Watson, 1989, **GL**. 1st and 2nd records.

72/2. DIPLOTAXIS TENUIFOLIA (L.) DC. **38**, Warks.: Side of railway, Birmingham, GR 42/08.87. J. W. Partridge, 1989, **WAR**, det. T. C. G. Rich. 2nd record.

†72/3. DIPLOTAXIS ERUCOIDES (L.) DC. *__28__, W. Norfolk: Edge of conifer plantation, Hockwold-cum-Wilton, GR 52/69.86. T. C. G. Rich, 1990, **LANC**.

†74/3. RAPHANUS SATIVUS L. **50**, Denbs.: Shingly riverbank, Tregeiriog, GR 33/17.33. J. A. Green, 1989. 2nd record.

†76/2. RAPISTRUM RUGOSUM (L.) All. **12**, N. Hants.: Disturbed sandy wasteland, Aldershot, GR 41/85.50. T. Dove & A. R. G. Mundell, 1990, **herb. A. Brewis**. 2nd record.

†81/1. CARDARIA DRABA (L.) Desv. *__93__, N. Aberdeen: Waste ground, Burnhaven, GR 48/13.44. D.Welch, 1990, **ABD**.

†84/2. THLASPI ALLIACEUM L. *__11__, S. Hants.: Edge of arable field. Lower Clockhouse Farm, Winkton, GR 40/16.96. F. A. Woodhead, 1987, **herb. F.A.W.**, det. R. P. Bowman.

89/1. SUBULARIA AQUATICA L. **72**, Dumfriess.: Shallow water over peaty substrate, Loch Skeen, GR 36/17.16. R. W. M. Corner, 1989. Only extant locality.

†90/2. BUNIAS ORIENTALIS L. **77**, Lanarks.: Waste ground, Low Blantyre, GR 26/69.57. K. Watson, 1990, **GL**. 2nd post-1930 record.

94/4. DRABA MURALIS L. †*__67__, S. Northumb.: Recently cleared ground, Stantonfence, GR 45/13.89. G. A. Swan, 1990, **herb. G.A.S.**

†96/1. ARMORACIA RUSTICANA P. Gaertner, B. Meyer & Scherb. *__73__, Kirkcudbrights.: Shore, Nun Mill, GR 25/65.48. O. M. Stewart, 1990.

†98/3. BARBAREA INTERMEDIA Boreau **94**, Banffs.: Roadside verge, Mulben, GR 38/35.50. J. Edelsten, 1988, **E**, det. T. C. G. Rich. 2nd record.

102/3. RORIPPA SYLVESTRIS (L.) Besser **94**, Banffs.: River shingle, R. Spey, GR 38/34.64. J. Edelsten, 1990, **E**, det. T. C. G. Rich. 2nd record.

†102/6. RORIPPA AUSTRIACA (Crantz) Besser *__77__, Lanarks.: Waste ground, Ruchill, Glasgow, GR 26/58.68. J. H. Dickson, 1988, **GL**. Still present in abundance, 1990.

102/†6 × 3. RORIPPA AUSTRIACA (Crantz) Besser × R. SYLVESTRIS (L.) Besser *__77__, Lanarks.: Cadder, Glasgow, GR 26/61.72. J. H. Dickson, 1989, **GL**, det. T. C. G. Rich.

†112/3. RESEDA ALBA L. **11**, S. Hants.: Bare gravelly soil, West Cliff, Hythe, GR 41/41.08. A. P. Holliwell, 1990. Only extant locality.

113/6. VIOLA CANINA L. **81**, Berwicks.: Sea braes, Burnmouth, GR 36/95.61. F. G. Hardy, 1990, det. A. J. Richards. 2nd localized record.

113/11. VIOLA LUTEA Hudson *__5__, S. Somerset: Rough pasture, Rugg's Hill, Brompton Regis, GR 21/98.31. G. Crouch & I. P. Green, 1990, **herb. R. G. B. Roe**, det. R. D. Meikle. 1st confirmed record and southerly extension of range, previous Somerset records having been doubted. Roadside knoll, Oldrey, GR 21/90.37. G. Crouch & I. P. Green, 1990. 2nd extant locality.

115/1. HYPERICUM ANDROSAEMUM L. †*__77__, Lanarks.: Pathside, Govan, GR 26/54.64. P. Macpherson, 1988. Waste ground, Hallside, GR 26/66.60. P. Macpherson, 1989. Both **herb. P.M.** 1st and 2nd records.

115/6a. HYPERICUM MACULATUM Crantz subsp. MACULATUM *__69__, Westmorland: Roadside, A685 road, Low Borrowbridge, GR 35/60.01. C. E. Wild, 1989, **LANC**, det. N. K. B. Robson.

115/6b × 5. HYPERICUM MACULATUM subsp. OBTUSIUSCULUM (Tourlet) Hayek × H. PERFORATUM L. *__4__, N. Devon: Quarry spoil, Cove, GR 21/95.20. L. J. Margetts, 1990, det. N. K. B. Robson. *__11__, S. Hants.: Hedge, Ampfield, GR 41/40.23. R. M. Veall, 1990, **herb. R. P. Bowman**, det. N. K. B. Robson.

122/1. ELATINE HEXANDRA (Lapierre) DC. **47**, Monts.: Lake margin, Llyn Ebyr, GR 22/9.8. I. C. Trueman & M. Wainwright, 1990. 2nd record.

123/12. SILENE NOCTIFLORA L. *__35__, Mons.: Garden weed, Chepstow, GR 31/52.93. T. G. Evans, 1982. Still present in 1990.

123/coe. SILENE COELI-ROSA (L.) Godron *__35__, Mons.: Gravelly island, Afon Llwyd east of Sebastopol, GR 31/30.97. T. D. Pollard & T. G. Evans, 1987, **herb. T.G.E.**, det. E. J. Clement.

127/8. DIANTHUS DELTOIDES L. *__75__, Ayrs.: Castle Hill, Ardrossan, GR 26/2.4. Gardiner, no date, **BM**. 1st and only record.

131/2. CERASTIUM ARVENSE L. **70**, Cumberland: Old sand quarry, East Brownrigg, GR 35/52.37. R. W. M. Corner, 1990, **LANC**. 1st post-1930 record.

133/3. STELLARIA PALLIDA (Dumort.) Piré **80**, Roxburghs.: Bare soil, Peniel Heugh near Ancrum, GR 36/65.25. R. W. M. Corner, 1990, **herb. R.W.M.C.** 2nd record.

133/4. STELLARIA NEGLECTA Weihe *__109__, Caithness: Arable field, St. Mary's Kirk, Forss, GR 39/0.7. M. McCallum Webster, 1968, **E**, det. A. O. Chater. 1st confirmed record.

141/1 mac. ARENARIA SERPYLLIFOLIA subsp. MACROCARPA (Lloyd) F. Perring & Sell *__46__, Cards.: Dune slack and grey dune, Ynys-las, GR 22/60.93. B.S.B.I. meeting, 1990, det. A. O. Chater.

153/bli. AMARANTHUS BLITOIDES S. Watson **25**, E. Suffolk: Fallow field, Ramsholt, GR 62/31.42. E. M. Hyde, 1989, **IPS**, det. E. J. Clement. 2nd record.

154/9. CHENOPODIUM FICIFOLIUM Sm. **38**, Warks.: Manure heap, Ettington Park, GR 42/24.47. H. A. Roberts, 1988, det. P. J. Copson. 2nd record.

154/14. CHENOPODIUM RUBRUM L. *__43__, Rads.: Roadside tip south of Upper Pitts Farm, Stanage, GR 32/31.70. R. G. Woods, 1990. Mud on lake margin, Llanbwchllyn, GR 32/12.46. D. R. Druit & I. D. Soane, 1990, det. R. G. Woods. 1st and 2nd records.

154/bot. CHENOPODIUM BOTRYS L. *__6__, N. Somerset: Roadside verge, Edington, GR 31/39.40. I. P. Green, 1990, **herb. J.M.M.**, det. J. M. Mullin.

156/1on. ATRIPLEX LONGIPES Drejer **68**, Cheviot: Under *Phragmites* at edge of salt-marsh, Alnmouth, GR 46/24.09. G. A. Swan, 1988, **herb. G.A.S.**, det. J. R. Akeroyd. 2nd record.

156/1on. × 3. ATRIPLEX LONGIPES Drejer × A. PROSTRATA Boucher ex DC. *__67__, S. Northumb.: Under *Phragmites* at edge of pond near mouth of Blakemoor Burn, GR 45/28.94. G. A. Swan, 1988, **herb. G. A. S.**, det. J. R. Akeroyd. *__68__, Cheviot: Under *Scirpus maritimus* at edge of salt-marsh near Beal Point, GR 46/08.42. G. A. Swan, 1987, det. P. M. Taschereau.

156/pra. ATRIPLEX PRAECOX Hülphers *__68__, Cheviot: Sand above high-tide mark, mouth of Brunton Burn, GR 46/22.27. G. A. Swan, 1988. Sand above high-tide mark, Budle Bay near Links End, GR 46/14.35. G. A. & M. Swan, 1988. Both **herb. G. A. S.**, det. J. R. Akeroyd. 1st and 2nd records.

160/2. SALICORNIA DOLICHOSTACHYA Moss *__75__, Ayrs.: Sandy/muddy shore, Hunterston, GR 26/19.52. A. McG. Stirling & A. Rutherford, 1990, **E**.

165/1. ALTHAEA OFFICINALIS L. †*__69__, Westmorland: Ditch, Rampside, Barrow-in-Furness, GR 34/23.66. P. Burton, 1989, **LANC**.

168/9. GERANIUM PYRENAICUM Burm. fil. *__72__, Dumfriess.: Roadside bank, Craigend Cottage, Georgetown, GR 35/01.74. M.E.R. Martin, 1990.

168/12. GERANIUM ROTUNDIFOLIUM L. †*__50__, Denbs.: Dry sandy ground, Marford Quarry, GR 33/35.56. P. Williams, 1990.

168/16b. GERANIUM ROBERTIANUM subsp. CELTICUM Ostenf. †*__99__, Dunbarton: Rosneath Caravan Park, GR 26/27.82. A. McSweeney, 1986, det. P. F. Yeo (as cv. Celtic White).

†170/2. Oxalis corniculata L. **73**, Kirkcudbrights.: Edge of burn, Creetown, GR 25/47.58. O. M. Stewart, 1988. 2nd record.

†171/2. Impatiens capensis Meerb. *__25__, E. Suffolk: Bank of R. Waveney, Beccles, GR 62/41.90. T. Abrehart, 1989.

†171/3. Impatiens parviflora DC. *__42__, Brecs.: Edge of plantation, Llangoed, GR 32/11.40. M. & C. Porter, 1990. Bank of R. Wye near Llangoed, GR 32/12.39. L. Bolingbroke, 1990. 1st and 2nd records. **94**, Banffs.: Woodland by R. Spey 4 km N. E. of Rothes, GR 38/30.50. J. Edelsten, 1990, **E**. 2nd record.

†Rhus typhina L. **41**, Glam.: Cutting above cycle trackway, Lower Swansea Valley, GR 21/66.93. G. Hutchinson, 1989, **NMW**. 2nd record. Spreading by suckers.

†182/2. Parthenocissus quinquefolia (L.) Planchon *__73__, Kirkcudbrights.: Edge of wood, Balmae, GR 25/68.44. O. M. Stewart, 1990.

185/1 tin. Genista tinctoria L. subsp. tinctoria **45**, Pembs.: Wet heath, Sageston Mountain Common, GR 22/06.03. S. B. Evans, 1990. 2nd extant locality.

†Cytisus striatus (Hill) Rothm. *__25__, E. Suffolk: Purdis Heath Golf Course, GR 62/21.43. N. Kerr, 1990, **herb. E. & M. Hyde**, det. E. J. Clement.

190/6. Medicago arabica (L.) Hudson †__51__, Flints.: St Asaph, GR 33/0.7. B. Gale, 1988. 2nd post-1930 record.

†192/7. Trifolium incarnatum L. *__52__, Anglesey: Soil in car park, Traeth Lligwy, GR 23/49.87. B.S.B.I. meeting, 1990.

192/16. Trifolium suffocatum L. **6**, N. Somerset: Short turf, Berrow Golf Course, GR 31/29.51. R. S. Cropper, 1990. 2nd record.

†198/1. Robinia pseudacacia L. **70**, Cumberland: Field edge, Lazonby, GR 35/55.39. R. W. M. Corner, 1989, **LANC**. 2nd record.

202/1. Ornithopus perpusillus L. †*__98__, Main Argyll: Sides of forestry roads near Ardbrecknish, GR 27/07.20. B. H. Thompson, 1989, **herb. B.H.T.**, det. C. D. Preston.

207/2. Lathyrus nissolia L. †__64__, Mid-W. Yorks.: Waste ground, Hellifield, GR 34/85.56. J. Allinson, 1990. 2nd record. †__69__, Westmorland: Roadside verge between Brough and Brough Sowerby, GR 35/79.13. P. M. Atkins, 1990. 2nd record. †*__99__, Dunbarton: Waste ground, Dalmonach, GR 26/39.80. K. Futter, 1990.

†209/2. Spiraea douglasii Hooker subsp. douglasii *__77__, Lanarks.: Old railway line, Meadowside, Glasgow, GR 26/55.66. P. Macpherson, 1989, **herb. P.M.**, det. A. J. Silverside.

†209/med. Spiraea media Franz Schmidt *__69__, Westmorland: Limestone quarry above Row, Whitbarrow, GR 34/45.88. C. E. Wild, 1989, **LANC**, det. A. J. Silverside.

†Aruncus dioicus (Walter) Fernald **69**, Westmorland: Roadside between Newby Bridge and Bowland Bridge, GR 34/40.88. G. Halliday, 1988. 2nd record.

211/2. Rubus saxatilis L. **47**, Monts.: Ravine near Llanbrynmair, GR 22/9.9. G. Morton, 1989. 2nd record.

†211/8. Rubus spectabilis Pursh *__79__, Selkirks.: Woodland, Glenkinnon Burn, Peel, GR 36/42.34. M. E. Braithwaite, 1990.

†211/10. Rubus loganobaccus L. H. Bailey *__79__, Selkirks.: Hedge south of Bridgelands, Selkirk, GR 36/47.30. R. W. M. Corner, 1989, **herb. R.W.M.C.**, det. A. Newton.

211/11/2. Rubus scissus W. C. R. Watson *__12__, N. Hants.: Heathy ride, Sandford Woods, GR 41/55.59. D. E. Allen & A. O. Chater, 1982, **BM**, det. A. Newton.

211/11/27. Rubus tuberculatus Bab. *__79__, Selkirks.: Roadside, Selkirk, GR 36/47.29. R. W. M. Corner, 1989, **herb. R.W.M.C.**, det. A. Newton.

211/11/32. RUBUS BRITANNICUS Rogers *__26__, W. Suffolk: Tuddenham Heath, GR 52/74.72. A. L. Bull, 1971, **herb. A.L.B.**, det. A. Newton.

211/11/44. RUBUS NITIDIFORMIS Sudre *__11__, S. Hants.: Scrub margin, Southampton Common, GR 41/41.17. D. E. Allen, 1988, **BM**, det. A. Newton.

211/11/126. RUBUS ERRABUNDUS W. C. R. Watson [**H30**, Co. Cavan: Delete record in Edees & Newton (1988), *Brambles of the British Isles*, p. 274. Specimen in **DBN** is *R. mucronulatus* Boreau, det. D. E. Allen.]

211/11/129. RUBUS ULMIFOLIUS Schott *__67__, S. Northumb.: Grassy bank, Wallsend Dene, GR 45/31.66. D. N. Mitchell & A. Coles, 1990, **herb. G. A. Swan**, det. A. Newton.

†211/11/139. RUBUS PROCERUS P. J. Mueller *__77__, Lanarks.: Lane-side, Hyndland, GR 26/55.67. A. McG. Stirling, 1989.

211/11/173. RUBUS BORAEANUS Genev. [**11**, S. Hants.: Delete record in Edees & Newton (1988), *Brambles of the British Isles*, p. 129. Provenance of specimen in **SLBI**, the basis of the record, is doubtful, fide D. E. Allen.]

211/11/240. RUBUS WATSONII W. H. Mills *__25__, E. Suffolk: Priestley Wood, Barking, GR 62/08.53. A. L. Bull, 1981, **herb. A. L. B.**, det. A. Newton.

211/11/297. RUBUS RADULOIDES (Rogers) Sudre *__12__, N. Hants.: Open birchwood, Combe Wood, Lickenholt, GR 41/35.59. D. E. Allen & A. Newton, 1989, **BM**.

211/11/aqu. RUBUS AQUARUM Newton & Porter *__42__, Brecs.: Hedgerow west of Llanwrtyd Wells, GR 22/87.45. M. Porter, 1988, **NMW**, det. A. Newton.

211/11/bil. RUBUS BILOENSIS Newton & Porter *__42__, Brecs.: Lane-bank near Llanfillo, GR 32/11.33. M. Porter, 1988, **NMW**, det. A. Newton.

†211/11/ele. RUBUS ELEGANTISPINOSUS (A. Schum.) H. E. Weber *__26__, W. Suffolk: Mildenhall Woods, GR 52/72.75. A. L. Bull, 1989, **herb. A.L.B.**, det A. Newton. *__79__, Selkirks.: Old railway, Galashiels, GR 36/49.74. R. W. M. Corner, 1989, **herb. R.W.M.C.**, det. G. Ballantyne & A. McG. Stirling.

211/11/ery. RUBUS ERYTHROPS Edees & Newton *__11__, S. Hants.: Margin of Red Wood, West Meon, GR 41/66.25. D. E. Allen, 1984, **herb. D.E.A.**, det A. Newton.

211/11/gal. RUBUS GALLOFUSCUS Newton & Porter *__41__, Glam.: Mynydd Bach near Lower Cwm-twrch, GR 22/76.09. M. Porter, 1988, **NMW**, det. A. Newton. *__42__, Brecs.: Gorsey bank, Penrhos near Ystradgynlais, GR 22/80.11. M. Porter, 1988, **NMW**, det A. Newton.

211/11/inf. RUBUS INFORMIFOLIUS Edees *__12__, N. Hants.: Margin of Chawton Park Wood, GR 41/67.36. D. E. Allen, 1975, **herb. D.E.A.**, det. A. Newton.

211/11/mer. RUBUS MERLINI Newton & Porter *__43__, Rads.: Thickets, Allt Goch, GR 22/9.7. A. Ley, 1892, **NMW**, det. A. Newton. *__44__, Carms.: Roadside bank, Cilycwm, GR 22/75.39. T. A. W. Davis, 1973, **NMW**, det. M. Porter.

211/11/nor. RUBUS NORVICENSIS A. L. Bull & Edees *__12__, N. Hants.: Shady edge of car park, Winchester Station, GR 41/47.30. D. E. Allen, 1982, **BM**.

211/11/pyd. RUBUS PYDARENSIS Rilstone *__4__, N. Devon: Trackside, Challice's Plantation, Eggesford, GR 21/68.09. W. H. Tucker, 1990, det. A. Newton.

211/11/rob. RUBUS ROBII (W. C. R. Watson) Newton *__42__, Brecs.: Wooded bank of R. Pyrddin, Pont-nedd-fechan, GR 22/89.09. M. Porter, 1990, **herb. M.P.**, det. A. Newton.

211/11/sur. RUBUS SURREJANUS W. C. Barton & Riddelsd. *__21__, Middlesex: Shrubbery weed, Regent's Park, GR 51/28.33. D. E. Allen, 1989, **BM**.

211/11/tam. RUBUS TAMARENSIS Newton *11, S. Hants.: Heath margin, Chilworth Common, GR 41/41.17. D. E. Allen, 1974, **herb. D. E. A.**, det. A. Newton. *12, N. Hants.: Hedge, Harewood Forest, GR 41/40.44. D. E. Allen, 1987, **BM**, det. A. Newton.

211/11/tav. RUBUS TAVENSIS Newton & Porter *42, Brecs.: Near Coed Wern Plemys, Ystradgynlais, GR 22/78.09. M. Porter, 1988, **NMW**, det. A. Newton.

211/11/tro. RUBUS TROIENSIS Newton *42, Brecs.: Hedge and wood, Llangynidr, GR 32/16.19. M. Porter, 1989, **herb. M.P.**, det. A. Newton.

211/11/vig. RUBUS VIGURSII Rilstone *4, N. Devon: Track through scrub, Kigbeare, Okehampton, GR 20/53.95. W. H. Tucker, 1990, det. A. Newton.

212/6. POTENTILLA ARGENTEA L. †*5, S. Somerset: Waste ground, Wembdon, GR 31/27.39. P. R. & I. P. Green, 1990. 72, Dumfriess.: Old sand pit, Dormont Grange, GR 35/11.74. M. E. R. Martin, 1986. Only extant locality.

*212/12. POTENTILLA CRANTZII (Crantz) G. Beck ex Fritsch 72, Dumfriess.: Rocky ledge, Blackhope, GR 36/13.11. R. W. M. Corner & H. Lang, 1989. Only extant locality.

212/15. POTENTILLA REPTANS L. 95, Moray: River shingle, Boat o'Brig, GR 38/31.50. J. Edelsten, 1988, **E**, det. B. Harold. 2nd record.

220/3/9. ALCHEMILLA GLOMERULANS Buser *68, Cheviot: Cliff by stream in deep ravine, Bellyside Burn, GR 36/90.22. G. A. Swan, 1990, **herb. G.A.S.**, det. S. M. Walters.

220/3/11. ALCHEMILLA WICHURAE (Buser) Stéfansson 72, Dumfriess.: Upland damp moorland, Midlaw Burn area, GR 36/1.1. R. W. M. Corner, 1989. 2nd post-1930 record.

†220/3/12. ALCHEMILLA MOLLIS (Buser) Rothm. *35, Mons.: Rough grassy roadside, Tredegar, GR 32/13.09. T. G. Evans & J. Killick, 1988. *49, Caerns.: Waste ground near Llyn Chwythlyn, north-east of Llanrwst, GR 23/83.65. R. Lewis, 1990, **NMW**. *69, Westmorland: Elliscales Quarry, Dalton-in-Furness, GR 34/22.74. P. Burton, 1988. By pond, Pinfold Bridge, Raisbeck, GR 35/64.07. C. E. Wild, 1989, **LANC**. 1st and 2nd records. *73, Kirkcudbrights.: Roadside verge by Rosebank Bridge, GR 25/87.76. O. M. Stewart, 1990.

†225/5. ROSA RUGOSA Thunb. *46, Cards.: Top of shingle beach below Penyrangor, Aberystwyth, GR 22/58.80. A. O. Chater, 1990, **NMW**. *77, Lanarks.: Waste ground, Linthouse, GR 26/54.66. P. Macpherson, 1985, **herb. P.M.** Still present in 1990.

225/8 × 10. ROSA CANINA L. × R. OBTUSIFOLIA Desv. *41, Glam.: Near Llanedeyrn, Cardiff, GR 31/2.8. A. E. Wade, 1969, **NMW**, det. A. L. Primavesi. 1st Welsh record.

225/8 × 14. ROSA CANINA L. × R. RUBIGINOSA L. *41, Glam.: Dutton's Quarry, Rhiwbina Hill, Cardiff, GR 31/14.83. G. Hutchinson, 1989, **NMW**, det. A. L. Primavesi.

225/8 × 15. ROSA CANINA L. × R. MICRANTHA Borrer *11, S. Hants.: Grassland near tidal creek, Ports Creek, Hilsea, GR 41/65.04. R. P. Bowman, 1990, **herb. R.P.B.**, det. A. L. Primavesi.

225/9 cae. ROSA CAESIA Sm. subsp. CAESIA *41, Glam.: Abernant, GR 32/01.03. J. W. Davies & A. E. Wade, 1973, **NMW**, det. A. L. Primavesi. *75, Ayrs.: Near Martnaham Loch, GR 26/40.17. A. McG. Stirling, 1988.

225/9 gla. ROSA CAESIA subsp. GLAUCA (Nyman) Graham & Primavesi 75, Ayrs.: Nobel Works, Ardeer, GR 26/27.40. A. McG. Stirling, 1988. 2nd record.

225/9 cae. × 8. ROSA CAESIA Sm. × R. CANINA L. *12, N. Hants.: Winnall Moors N.R., GR 41/48.30. J. Fryer, 1988, **herb. A. L. Primavesi**, det. A.L.P.

225/9 gla. × 8. ROSA CAESIA subsp. GLAUCA (Nyman) Graham & Primavesi × R. CANINA L. *41, Glam.: Abernant, GR 32/01.03. J. W. Davies, A. Newton & A. E. Wade, 1973, **NMW**, det. A. L. Primavesi. 1st Welsh record.

225/11 × 8. ROSA TOMENTOSA Sm. × R. CANINA L. *41, Glam.: Hedgerow north of Mountain Ash, GR 32/0.0. A. E. Wade, 1975, **NMW**, det. A. L. Primavesi.

225/12. Rosa sherardii Davies **11**, S. Hants.: Roadside, Goatspen Plain, GR 41/23.01. Scrub, Burley Beacon, GR 41/20.02. Both R. P. Bowman, 1990, **herb. R.P.B.**, det. A. L. Primavesi. Only extant localities. *__75__, Ayrs.: Ayr, GR 26/3.2. P. Ewing, 1889, **GL**, det. A. McG. Stirling. 1st confirmed record.

225/14. Rosa rubiginosa L. *__35__, Mons.: Gritty bank near B4248 road, Blaenavon, GR 32/25.09. T. G. Evans & R. Fraser, 1988, **herb. T.G.E.**, det. G. G. Graham. *__79__, Selkirks.: Old railway, Galashiels, GR 36/47.37. R. W. M. Corner, 1989, **SUN**, det. G. G. Graham.

†226/ser. Prunus serotina Ehrh. *__46__, Cards.: Sessile oakwood, Allt Fawr, Llanwnnen, GR 22/54.47. A. O. Chater, 1990, **NMW**. Abundant and locally dominant.

†227/3. Cotoneaster horizontalis Decne *__81__, Berwicks.: Natural rock outcrop, Cockburn Mill, GR 36/77.58. M. E. Braithwaite, 1990.

†227/5. Cotoneaster frigidus Wall. ex Lindley *__35__, Mons.: Rough grassland, Cwmtillery, GR 32/22.04. R. Fraser, 1988.

†227/reh. Cotoneaster rehderi Pojarkova *__70__, Cumberland: Clints Quarry, Egremont, GR 35/00.12. A. Dudman, 1989, **LANC**, det. J. Fryer.

†227/ste. Cotoneaster sternianus Boiss. *__70__, Cumberland: Old railway line, Harrington, GR 25/99.25. A. Dudman, 1989, **LANC**, det. J. Fryer.

232/7. Sorbus torminalis (L.) Crantz **41**, Glam.: Roadside near Earlswood Roundabout, Crymlyn Burrows, GR 21/72.93. C. R. Hipkin, 1990. 2nd post-1930 record.

237/1. Crassula tillaea Lester-Garland **12**, N. Hants.: Old railway track, Woolmer Forest, GR 41/79.31. F. Rose, 1990. 2nd extant locality.

†237/hel. Crassula helmsii (T. Kirk) Cockayne *__28__, W. Norfolk: Pond on common, Tottenhill Row, GR 53/63.10. C. D. Preston, 1987, **CGE**. Pond, Tottenhill, GR 53/67.89. H. Williamson, 1990. 1st and 2nd records.

239/6. Saxifraga hirsuta L. †*__77__, Lanarks.: Wood, Thorntonhall, GR 26/58.54. P. Macpherson, 1989, **herb. P.M.**

†Darmera peltata (Torrey) Voss *__77__, Lanarks.: Well naturalized in damp wood east of Busby, GR 26/58.55. P. Macpherson, 1989, **herb. P.M.**, det. C. A. Stace.

247/2. Drosera anglica Hudson **72**, Dumfriess.: Wet flushes near road below Auchenstroan Craig, GR 25/69.91. A. McG. Stirling, 1960. Wet pools at centre of bog, Lochar Moss, Longbridgemuir, GR 35/04.69. A. J. Kerr & L. V. Fleming, 1990. 1st and 2nd post-1930 records.

252/1. Hippophae rhamnoides L. †*__73__, Kirkcudbrights.: Shingle bank, island south of St Mary's Isle, GR 25/66.48. O. M. Stewart, 1990. 1st record of self-sown plants.

†256/1. Oenothera biennis L. **75**, Ayrs.: Waste ground, Troon, GR 26/23.42. R. Mackechnie, 1952. 2nd record.

†256/2. Oenothera erythrosepala Borbás *__43__, Rads.: Ddol Road Industrial Estate, Llandrindod Wells, GR 32/06.62. R. G. Woods, 1990.

†259/aqu. Myriophyllum aquaticum (Velloso) Verdcourt *__25__, E. Suffolk: Pool, Landguard Common, GR 62/28.31. A. Copping, 1985. Still present in 1988. *__39__, Staffs.: Canal 1 km west of Aldridge, GR 43/04.00. J. P. Martin, 1990, **herb. B.R. Fowler**. *__67__, S. Northumb.: Mud at edge of small pond near Brenkley, GR 45/22.75. G. A. Swan, 1990, **herb. G.A.S.**

262/3. Callitriche obtusangula Le Gall **73**, Kirkcudbrights.: Glenamour Loch, GR 25/44.67. O. M. Stewart, 1989, **E**. 2nd record.

262/5. Callitriche hermaphroditica L. *__38__, Warks.: Longmoor Pool, Sutton Park, GR 42/09.95. J. W. Partridge, 1990, **WAR**, det. J. C. Bowra & P. J. Copson.

262/bru. CALLITRICHE BRUTIA Petagna **46**, Cards.: Mud on side of dried-up pond, Glanrheidol, Capel Bangor, GR 22/66.79. A. O. Chater, 1990, **NMW**, det. C. D. Preston & N. F. Stewart. 2nd record, 1st since 1894.

†265/2. CORNUS SERICEA L. *__73__, Kirkcudbrights.: Wood near Gelston, GR 25/77.58. O. M. Stewart, 1988.

†271/1. ASTRANTIA MAJOR L. *__26__, W. Suffolk: Edge of flooded gravel pits, Lackford, GR 52/79.70. Suffolk Wildlife Trust recording team, 1987.

274/1. ANTHRISCUS CAUCALIS Bieb. *__47__, Monts.: Short grass and hedge bottom, Crew Green, GR 33/31.15. S. Stafford, 1977. Still present in 1990.

†283/5. BUPLEURUM FALCATUM L. *__35__, Mons.: Garden weed, Chepstow, GR 31/52.93. T. G. Evans, 1980, **herb. T.G.E.** Still present in 1990. 2nd Welsh record. *__64__, Mid-W. Yorks.: Basic grassland on steep riverside bank, Bolton Abbey, GR 44/07.55. F. Draper & A. Gramshaw, 1990, det. J. Duncan.

291/1. CARUM VERTICILLATUM (L.) Koch *__35__, Mons.: Wet flush in woodland glade near Blaina, GR 32/2.0. J. Wohlgemuth, 1990, **herb T. G. Evans**. *__96__, Easterness: Amongst *Molinia*, east end of Loch Insh, GR 28/83.05. D. Wood, 1990.

291/2. CARUM CARVI L. __38__, Warks.: Meadow, Bidford-on-Avon, GR 42/10.50. D. Boyce, 1990, **WAR**, det. J. C. Bowra. 2nd record, 1st since 1860.

300/1. OENANTHE SILAIFOLIA Bieb. *__54__, N. Lincs.: Water meadows, Lea Marshes near Gainsborough, GR 43/81.86. R. Nickerson, 1990, det. T. Dixon & I. Weston.

†319/4. EUPHORBIA CORALLIOIDES L. __35__, Mons.: Garden weed, Chepstow, GR 31/52.93. T. G. Evans, 1980. Still present in 1990. 2nd record.

319/†16 × †15. EUPHORBIA CYPARISSIAS L. × E. ESULA L. *__26__, W. Suffolk: Forest ride, King's Forest, GR 52/83.73. E. M. Hyde, 1990, **IPS**, det. A. Radcliffe-Smith.

†319/17 rob. EUPHORBIA AMYGDALOIDES subsp. ROBBIAE (Turrill) Stace *__39__, Staffs.: Side of pasture west of Upper Penn, Wolverhampton, GR 32/88.95. B. R. Fowler, 1990, **herb. B.R.F**., det. A. Radcliffe-Smith.

†319/wal. EUPHORBIA WALDSTEINII (Soják) R.-Sm. *__77__, Lanarks.: Grass bank above railway, Govan, GR 26/54.64. P. Macpherson, 1986, **herb. P.M.**, det. A. Radcliffe-Smith. Still present in 1990.

320/1/3. POLYGONUM RURIVAGUM Jordan ex Boreau __46__, Cards.: Cabbage field, Mwnt, GR 22/19.52. A. O. Chater, 1990, **NMW**. 2nd record.

320/1/are. POLYGONUM ARENASTRUM Boreau __50__, Denbs.: Rubbish tip, Denbigh, GR 33/05.65. J. A. Green, 1989. 2nd record.

320/3. POLYGONUM MARITIMUM L. __1__, W. Cornwall: Shingly sand amongst boulders, Gunwalloe Church Cove, GR 10/66.20. P. Bowman, 1990, det. R. J. Murphy. Only extant locality. __11__, S. Hants.: Sand spit, Hengistbury, GR 40/18.91. T. Warwick, 1990, det. A. J. Byfield, D. A. Pearman & R. M. Walls. 1st record since 1902.

320/13. POLYGONUM MITE Schrank __50__, Denbs.: Edge of farm pond, Little Green Farm, Penley, GR 33/41.40. J. A. Green, 1990. 2nd record.

320/14. POLYGONUM MINUS Hudson __34__, W. Gloucs.: Small dried-out pond, Coalway Lane End, Coleford, GR 32/59.10. K. Herring, 1990. Only extant locality.

†320/18. FALLOPIA AUBERTII (Louis Henry) J. Holub *__42__, Brecs.: Hedge, Llanfilo, GR 32/11.33. Hedge, Glangrwyney, GR 32/23.16. Both M. Porter, 1990. 1st and 2nd records. __51__, Flints.: Gronant, GR 33/0.8. P. I. Morris, 1985. 2nd record.

†320/20. Reynoutria sachalinensis (Friedrich Schmidt Petrop.) Nakai **49**, Caerns.: Waste ground, Glyn Isa Hotel, Rowen, GR 23/76.72. R. Lewis, 1990. 2nd record. *__94__, Banffs.: Neglected garden, Forglen, GR 38/69.52. J. Edelsten, 1988, **E**, det. A. P. Conolly.

†320/22. Polygonum campanulatum Hooker f. **70**, Cumberland: Knowefield Wood, Stanwix, GR 35/40.57. R. E. Groom, 1989, **LANC**. 2nd record.

325/11 lit. Rumex crispus subsp. littoreus (Hardy) Akeroyd *__75__, Ayrs.: Shingle shore, Knock, Largs, GR 26/19.63. Shingle shore, Ardneil Bay, GR 26/18.48. Both A.McG. Stirling, 1990. 1st and 2nd records. *__99__, Dunbarton: Shingle beach, Knockderry, GR 26/21.83. A. Rutherford, 1990.

†330/tho. Ulmus thomasii Sarg. *__50__, Denbs.: Disused gravel quarry, Marford near Wrexham, GR 33/35.56. J. A. Green, 1989. 1st Welsh record.

†336/2. Alnus incana (L.) Moench *__35__, Mons.: Roadside hedge, Llanbadoc, GR 31/37.98. T. G. & U. T. Evans, 1988.

343/2 × 4. Salix alba L. × S. fragilis L. *__52__, Anglesey: Margin of Llyn yr Wyth-Eidion, GR 23/47.81. C. D. Preston & N. F. Stewart, 1988, **CGE**, det. R. D. Meikle.

343/11b. Salix caprea subsp. sericea (N. J. Andersson) B. Flod. *__79__, Selkirks.: Wooded cleuch, Hermanlaw Burn, Little Yarrow, GR 36/22.16. D. J. McCosh, 1988, **herb. D.J.McC**., det. R. D. Meikle (as *S. caprea* var. *sphacelata* (Sm.) Wahlenb.). 1st record outwith Scottish Highlands.

343/11 × 9. Salix caprea L. × S. viminalis L. *__5__, S. Somerset: Hedges, Clinton Trinity, GR 31/29.39. P. R. Green, 1990, det. R. D. Meikle. *__52__, Anglesey: Edge of Llyn Maelog, GR 23/32.72. C. D. Preston & N. F. Stewart, 1988, **CGE**, det. R. D. Meikle.

343/12 × 15. Salix cinerea L. × S. phylicifolia L. *__96__, Easterness: Bushy ground, Kincraig, GR 28/83.05. B. H. Thompson, 1990, **herb. B.H.T.**, det. R. D. Meikle.

343/16a. Salix repens L. subsp. repens *__43__, Rads.: Wet pasture, Rhosgoch Common, GR 32/19.48. R. G. Woods, 1990. 1st localized record.

†351/1. Gaultheria shallon Pursh **70**, Cumberland: Woodland, Eskdale Green, GR 35/14.00. M. M. Gill, 1990. 2nd record.

354/1. Arctostaphylos uva-ursi (L.) Sprengel **73**, Kirkcudbrights.: Rock ledge in gorge, Louran Burn, Cairnsmore of Fleet, GR 25/48.68. R. W. M. Corner, 1990. 2nd record.

358/4. Vaccinium oxycoccos L. **51**, Flints.: Upland heather moor, Llyn Cyfynwy, GR 33/2.5. G. Wynne, 1989. 2nd record.

364/2. Empetrum hermaphroditum Hagerup *__73__, Kirkcudbrights.: Ledges and boulder areas, Cairnsmore of Fleet, GR 25/49.67. R. W. M. Corner, 1990, **herb. R.W.M.C.**

385/3/2 Gentianella amarella subsp. septentrionalis (Druce) Pritchard *__64__, Mid-W. Yorks.: Steep limestone grassland, Kettlewell, GR 34/96.72. P. P. Abbott, 1990, det. N. M. Pritchard. Extends range by 160 km to south.

†392/ibi. Symphytum ibiricum Stevens *__69__, Westmorland: Roadside verge south of Bendrigg Lodge, Killington, GR 34/57.88. C. E. Wild, 1990, **LANC**.

400/8 umb. Myosotis arvensis subsp. umbrata (Rouy) Schwarz *__99__, Dunbarton: Wood margin near Meikleross Bay, GR 26/26.80. A. McG. Stirling & A. Rutherford, 1986, **E**.

401/3. Lithospermum arvense L. **61**, S. E. Yorks.: Arable field south-east of Thornton, GR 44/77.44. D. R. Grant, 1990. Only extant locality.

402/1. Mertensia maritima (L.) S. F. Gray **73**, Kirkcudbrights.: Stones near high-water mark, Howell Bay, GR 25/69.43. O. M. & N. F. Stewart, 1990. 2nd extant locality.

406/†2 × 1. CALYSTEGIA PULCHRA Brummitt & Heywood × C. SEPIUM (L.) R. Br. subsp. SEPIUM *54, N. Lincs.: Hedge, Riseholme Lane, Riseholme, GR 43/98.75. I. Weston, 1989, **K**, det. R. K. Brummitt.

409/1. LYCIUM BARBARUM L. *73, Kirkcudbrights.: Wall, Kirkandrews old churchyard, GR 25/60.48. D. Cockerill, 1978. Old wall near Senwick, GR 25/65.46. O. M. Stewart, 1990. 1st and 2nd records.

†420/2. LINARIA PURPUREA (L.) Miller 72, Dumfriess.: Street weed, Tynron near Thornhill, GR 25/80.93. M. E. R. Martin, 1990. 2nd record.

420/†2 × 3. LINARIA PURPUREA (L.) Miller × L. REPENS (L.) Miller *46, Cards.: Scrub on railway ballast, Aberystwyth, GR 22/58.81. A. O. Chater, 1990, **NMW**. With both parents.

420/3 × 4. LINARIA REPENS (L.) Miller × L. VULGARIS Miller *77, Lanarks.: Along fence, Kelvindale, GR 26/55.68. K. M. Calver, 1964, **herb. P. Macpherson**. Still present in 1989.

427/1. SIBTHORPIA EUROPAEA L. *35, Mons.: Mossy bank near stream, Cwmfelinfach, GR 31/18.92. R. Fraser, 1990, **herb. T. G. Evans**.

†428/1. ERINUS ALPINUS L. *39, Staffs.: Mossy wall, Wolseley Hall, Colwich, GR 43/02.20. B. R. Fowler, 1990.

†430/9. VERONICA LONGIFOLIA L. *69, Westmorland: Roadside verge between Casterton and Kirkby Lonsdale, GR 34/64.79. K. Butler, 1989, **LANC**. *73, Kirkcudbrights.: Roadside bank south of Cassencarie, GR 25/47.57. O. M. Stewart, 1988.

†430/14. VERONICA PEREGRINA L. 81, Berwicks.: Walled vegetable garden, Newton Don, GR 36/70.37. M. E. Braithwaite, 1990, **herb. M.E.B.** 1st record since 1893 record in same locality.

430/20 hed. VERONICA HEDERIFOLIA L. subsp. HEDERIFOLIA *81, Berwicks.: Waste ground, Duns, GR 36/79.53. M. E. Braithwaite, 1990, **herb. M.E.B.**

434/3. MELAMPYRUM PRATENSE L. 29, Cambs.: Ditch bank by hedge, Balsham, GR 52/58.51. P. J. O. Trist, 1990, **CGE**. 1st record since 1930. 61, S. E. Yorks.: Woodland west of Thornton, GR 44/72.45. T. E. Dixon, 1989. Only extant locality.

435. EUPHRASIA. All records below are based on specimens determined by A. J. Silverside.

435/1/2. EUPHRASIA SCOTTICA Wettst. *83, Midlothian: Base-rich upland flush, Trously, GR 36/38.45. D. R. McKean, 1988, **E**.

435/1/1 × 2. EUPHRASIA MICRANTHA Reichenb. × E. SCOTTICA Wettst. *42, Brecs.: Montane flush, Cwm Dergwm, GR 32/05.21. M. Porter, 1987, **herb. M.P.** 1st Welsh record.

435/1/15 × 1 EUPHRASIA CONFUSA Pugsley × E. MICRANTHA Reichenb. *73, Kirkcudbrights.: Forestry track below Craignane, GR 26/57.04. O. M. Stewart, 1988, **E**.

435/1/15 × 13. EUPHRASIA CONFUSA Pugsley × E. NEMOROSA (Pers.) Wallr. *35, Mons.: Pathside, Chepstow Park Wood, GR 31/49.97. T. G. & U. T. Evans, 1985, **herb. T.G.E.**

435/1/16. EUPHRASIA PSEUDOKERNERI Pugsley 46, Cards.: Rough grassland on cliff top, R. A. E. site, Aberporth, GR 22/24.52. A. O. Chater, 1979, **NMW**. 2nd record.

435/1/17 × 13. EUPHRASIA ARCTICA subsp. BOREALIS (Townsend) Yeo × E. NEMOROSA (Pers.) Wallr. *35, Mons.: Heathy grassland west of Pontypool, GR 32/26.00. T. G. & U. T. Evans, 1986, **herb. T.G.E.** 1st Welsh record.

437/1. PARENTUCELLIA VISCOSA (L.) Caruel †95, Moray: Damp, acidic grassland, R. A. F. Lossiemouth, GR 38/19.69. D. Law, 1989, **E**, det. D. J. Hambler. Only extant locality.

440/10. OROBANCHE HEDERAE Duby †12, N. Hants.: On *Hedera hibernica*, road between Old Alresford and Bighton, GR 41/59.34. E. Nicholl, 1989, **herb. A. Brewis** (forma *monochroma* G. Beck). 2nd record. †*42, Brecs.: Deserted garden, Brecon, GR 32/04.28. C. Cooper, 1990. 1st localized record.

445/2. MENTHA PULEGIUM L. **12**, N. Hants.: Edge of pond, Police College, Bramshill, GR 41/75.58. B. Meyrick, 1977. 1st record since 1870. †**25**, E. Suffolk: Porters Wood, Woodbridge, GR 62/26.48. J. Ryland, 1990, det. M. N. Sanford.

445/3 × †5. MENTHA ARVENSIS L. × M. SPICATA L. *__42__, Brecs.: Edge of pool, Glasbury, GR 32/18.40. M. Porter, 1990, **NMW**.

445/†5 × 7. MENTHA × VILLOSA Hudson nm. ALOPECUROIDES (Hull) Briq. *__75__, Ayrs.: Foreshore, Hunterston, West Kilbride, GR 26/10.52. A. McG. Stirling & A. Rutherford, 1990.

461/1 arg. LAMIASTRUM GALEOBDOLON subsp. ARGENTATUM (Smejkal) Stace *__77__, Lanarks.: Grassy bank, Maryhill, Glasgow, GR 26/56.69. P. Macpherson, 1988, **herb. P.M.**, det. A. McG. Stirling. Roadside verge, Moodiesburn, GR 26/70.71. H. J. Noltie & K. Watson, 1988. 1st and 2nd records.

465/4/2. GALEOPSIS BIFIDA Boenn. **109**, Caithness: Garden weed, Thurso, GR 39/10.68. J. K. Butler, 1977, **herb. J.K.B.**, det. C. C. Townsend. Only extant locality.

472/1 int. PLANTAGO MAJOR subsp. INTERMEDIA (DC.) Arcangeli *__39__, Staffs.: Dry margin of Knypersley Reservoir, GR 33/89.55. I. W. Brown, 1989, det. J. R. Akeroyd. **73**, Kirkcudbrights.: Damp ground by shore west of Kirkandrews, GR 25/59.48. O. M. Stewart, 1990. 2nd record.

472/2. PLANTAGO MEDIA L. **42**, Brecs.: Grass verge, Buckland, GR 32/13.21. M. Porter, 1988. 2nd record. **94**, Banffs.: Grassland in cemetery, Keith, GR 38/43.51. J. Edelsten, 1990, **E**. 1st post-1930 record.

484/1. GALIUM CRUCIATA (L.) Scop. *__93__, N. Aberdeen: Laneside bank, Huntly, GR 38/53.39. D. Welch, 1990. 1st confirmed record.

*487/1. SAMBUCUS EBULUS L. 70, Cumberland: Grass verge and hedge bottom, Oulton, GR 35/24.50. R. E. Groom, 1990, **LANC**. 1st post-1930 record.

†491/1. LONICERA XYLOSTEUM L. **50**, Denbs.: Deciduous wood, Loggerheads, Mold, GR 33/19.62. B. Ing, 1988. 2nd post-1930 record. *__95__, Moray: Wood on riverbank, Dulnain Bridge, GR 28/99.24. J. Edelsten, 1989, **E**. *__99__, Dunbarton: Wood by shore, Cove, Loch Long, GR 26/22.82. A. McG. Stirling & A. Rutherford, 1990, **E**.

†491/inv. LONICERA INVOLUCRATA Banks *__70__, Cumberland: Large patch between road and shore near Cote lighthouse, Silloth, GR 35/11.54. R. E. Groom, 1990, **LANC**.

†491/nit. LONICERA NITIDA Wilson *__77__, Lanarks.: Along fence, Hutchesontown, GR 26/59.64. Waste ground, Govan, GR 26/55.65. Both P. Macpherson, 1988, **herb. P.M.**, det. D. McClintock. 1st and 2nd records.

†506/4. SENECIO SQUALIDUS L. *__109__, Caithness: Trackside, Pennyland Farm, Thurso, GR 39/11.68. J. M. Gunn, 1990, det. J. K. Butler.

†BRACHYGLOTTIS cultivar SUNSHINE C. Jeffrey (*Senecio greyi* hort.) *__77__, Lanarks.: Grassy area near river, Meadowside, Glasgow, GR 26/55.66. P. Macpherson, 1988, **herb. P.M.**, det. D. McClintock.

†509/3. PETASITES JAPONICUS (Siebold & Zucc.) Maxim. *__35__, Mons.: Bank of Berthin Brook, Usk, GR 32/370.019. C. Titcombe, 1989, det. T. G. Evans. Bank of Berthin Brook, Usk, GR 32/365.019. T. G. & U. T. Evans, 1990, **NMW**. 1st and 2nd records. *__73__, Kirkcudbrights.: Banks of Old Water near Rosebank, GR 25/87.76. O. M. Stewart, 1990.

514/2. FILAGO LUTESCENS Jordan **29**, Cambs.: Sand pit, Little Abington, GR 52/5.5. B. Jackson & J. Hirsh, 1990, **CGE**, det. P. D. Sell. 1st post-1930 record.

517/1. ANTENNARIA DIOICA (L.) Gaertner **72**, Dumfriess.: Upland moorland near Midlaw Linn, GR 36/1.1. R. W. M. Corner, 1989. Only extant locality.

†518/3. SOLIDAGO GIGANTEA Aiton *__73__, Kirkcudbrights.: Edge of wood west of Summerville, GR 25/95.76. O. M. Stewart, 1980. 2nd record.

†536/exa. ECHINOPS EXALTATUS Schrader __25__, E. Suffolk: Roadside verge, Finningham, GR 62/06.68. 2nd record. *__26__, W. Suffolk: Roadside verge south of Daisy Green, Great Ashfield, GR 62/00.67. Both R. Addington, 1989, **herb. E. & M. Hyde**, det. E. J. Clement.

538/3. ARCTIUM PUBENS Bab. *__67__, S. Northumb.: Edge of field near Dinnington, GR 45/22.73. *__68__, Cheviot: Roadside verge, Cawledge Burn, GR 46/19.10. Roadside verge near East Allerdean, GR 36/98.46. 1st and 2nd confirmed records. All G. A. Swan, 1990, **herb. G.A.S.**, det. F. H. Perring.

542/1. ONOPORDON ACANTHIUM L. †__50__, Denbs.: Railway embankment, Marford, GR 33/36.56. C. R. J. Williams, 1990. 2nd post-1930 record.

†544/2. CENTAUREA MONTANA L. *__99__, Dunbarton: Rough ground near Station, Rhu, GR 26/27.84. A. Rutherford, 1975. *__109__, Caithness: Roadside verge 9 km north-west of Wick, GR 39/30.57. M. McCallum Webster, 1978.

†552/2. TRAGOPOGON PORRIFOLIUS L. __50__, Denbs.: Field gateway, Colwyn Bay, GR 23/85.77. D. Lloyd, 1989. 2nd record.

558. HIERACIUM. Contrary to normal practice, some 1st post-1930 records of *Hieracium* sect. *Alpina* are published below. These have been provided by D. J. Tennant, who has revised the British species in this section in collaboration with P. D. Sell. A list of specimens of *Hieracium* sect. *Alpina* determined by Mr Tennant has been deposited with the Biological Records Centre.

558/1/5. HIERACIUM HOLOSERICEUM Backh. __87__, W. Perth: Rocky ledge near Creagan Liatha, Stob Binnein, GR 27/42.21. D. J. Tennant, 1981, **herb. D.J.T.** 1st record since 1891. __89__, E. Perth: Rocky ground between Cairnwell and Carn nan Sac, Glen Shee, GR 37/12.77. D. J. Tennant, 1974, **herb. D.J.T.** 1st post-1930 record.

558/1/8. HIERACIUM CALENDULIFLORUM Backh. __90__, Angus: Granitic outcrop above Loch Brandy, GR 37/33.75. D. J. Tennant, 1975, **herb. D.J.T.** 1st post-1930 record.

558/1/9. HIERACIUM MACROCARPUM Pugsley __92__, S. Aberdeen: Rocky ground, Soldier's Corrie, Cairn Toul, GR 27/96.96. D. J. Tennant, 1975, **CGE**, det. P. D. Sell. 1st record since 1887.

558/1/10. HIERACIUM GRANITICOLA W. R. Linton __94__, Banffs.: Rocky slope above Loch Avon, GR 38/00.03. D. J. Tennant, 1981, **herb. D.J.T.** 1st record since 1898. __96__, Easterness: Turf over scree, E. slope of Cairngorm, GR 38/01.04. D. J. Tennant, 1981, **herb. D.J.T.** 1st record since 1898.

558/1/16. HIERACIUM HANBURYI Pugsley *__87__, W. Perth: Rock ledges, Stob Garbh, Cruach Ardrain, GR 27/41.21. D. J. Tennant, 1971, **CGE**.

558/1/32. HIERACIUM DASYTHRIX (E. F. Linton) Pugsley *__77__, Lanarks.: Falls of Clyde, GR 26/88.41. D. J. McCosh, 1988, **herb. D.J.McC.**, det. P. D. Sell.

558/1/41. HIERACIUM FLOCCULOSUM Backh. *__77__, Lanarks.: Vertical rocks, Falls of Clyde, GR 26/88.41. D. J. McCosh, 1988, **herb. D.J.McC.**, det. P. D. Sell.

558/1/42. HIERACIUM SHOOLBREDII E. S. Marshall *__77__, Lanarks.: Rocks by R. Clyde, Bonnington Linn, GR 26/8.4. A.McG. Stirling, 1970.

558/1/78. HIERACIUM SANGUINEUM (A. Ley) W. R. Linton *__77__, Lanarks.: Slab rocks, Falls of Clyde, GR 26/88.41. D. J. McCosh, 1988, **herb. D. J. McC.**, det. P. D. Sell.

558/1/91. HIERACIUM CYMBIFOLIUM Purchas *__77__, Lanarks.: Slab rocks, Corra Linn, GR 26/88.41. D. J. McCosh, 1988, **CGE**, det. P. D. Sell.

558/1/219. HIERACIUM SABAUDUM L. *__81__, Berwicks.: Riverside rocks, Preston Bridge, GR 36/78.56. M. E. Braithwaite, 1990, det. D. J. McCosh. *__94__, Banffs.: Roadside verge 1 km south-west of Aberchirder, GR 38/61.51. J. Edelsten, 1987, **E**, det. J. Bevan.

558/1/ins. HIERACIUM INSIGNE Backh. **92**, S. Aberdeen: Rocky slope, Coire an Lochain Uaine, Cairn Toul, GR 27/95.98. D. J. Tennant, 1974, **CGE**, det. D. J. T. & P. D. Sell. 1st record since 1857.

558/1/mar. HIERACIUM MARGINATUM Sell & C. West *97, Westerness: Mica-schist cliffs, Coire Ardair, Creag Meagaidh, GR 27/43.88. D. J. Tennant, 1979, **herb. D.J.T.**, det. D.J.T. & P. D. Sell.

558/1/mem. HIERACIUM MEMORABILE Sell & C. West **92**, S. Aberdeen: Cliff ledge, head of Glen Callater, GR 37/19.81. D. J. Tennant, 1978, **herb. D.J.T.**, det. D. J. T. & P. D. Sell. 1st post-1930 record.

558/1/ten. HIERACIUM TENUIFRONS Sell & C. West **88**, Mid Perth: Crumbling scree, Creag Roro, Ben Lawers, GR 27/63.45. D. J. Tennant, 1979, **herb. D.J.T.** 1st post-1930 record. **92**, S. Aberdeen: Rock gulley, Coire Etchachan, GR 37/01.99. D. J. Tennant, 1976, **herb. D.J.T.**, det. D. J. T. & P. D. Sell. 1st post-1930 record.

558/1/sub. HIERACIUM SUBCRASSUM (Almq. ex Dahlst.) Johans. *76, Renfrews.: Roadside, Langside Drive, Glasgow, GR 26/57.60. P. Macpherson, 1988, **herb. D. J. McCosh**, det. D. J. McC.

†558/2/8. HIERACIUM BRUNNEOCROCEUM Pugsley **94**, Banffs.: Grass verge, Banff, GR 38/69.63. J. Edelsten, 1990, **E.** 2nd record.

†559/3. CREPIS SETOSA Haller fil. *5, S. Somerset: Sea bank, Otterhampton, GR 31/26.44. A. C. Leslie & P. R. Green, 1990, **herb. A.C.L.** *11, S. Hants.: Lightly shaded streamside path, Bartley Water, Rum Bridge, Totton, GR 41/35.12. Grassy area near Kingfisher Lake, Testwood, GR 41/35.14. Both R. M. Veall, 1990, **herb. R.P. Bowman**. 1st and 2nd records. *77, Lanarks.: Rough lawn, Shieldhall, Glasgow, GR 26/53.65. P. Macpherson, 1984. Grassy bank, Linthouse, Glasgow, GR 26/54.66. P. Macpherson, 1985. Both **herb. P.M.**, det. C. D. Preston. 1st and 2nd records.

559/8. CREPIS PALUDOSA (L.) Moench *35, Mons.: Wet margin of Afon Cibi, The Park, Abergavenny, GR 32/28.17. R. Fraser, 1990, **herb. T. G. Evans.**

†571/1. LAGAROSIPHON MAJOR (Ridley) Moss **29**, Cambs.: Roadside pond, Swavesey, GR 52/36.68. J. H. Belcher & E. M. F. Swale, 1989. 2nd record.

557/5 × 1. POTAMOGETON LUCENS L. × P. NATANS L. *27, E. Norfolk: Dyke, Limpenhoe Marshes, GR 63/39.02. C. Doakes & J. Spray, 1989, **NWH**, det. C. D. Preston & N. F. Stewart.

577/6 × 1. POTAMOGETON GRAMINEUS L. × P. NATANS L. *87, W. Perth: R. Leny south of Loch Lubnaig, GR 27/58.09. C. D. Preston & N. F. Stewart, 1986 and 1990, **CGE**. *97, Westerness: Edge of Loch Shiel east of Acharacle Pier, GR 17/68.67. M. G. B. Hughes, D. Morgana & C. D. Preston, 1990, **CGE**.

577/16. POTAMOGETON TRICHOIDES Cham. & Schlecht. [**12**, N. Hants.: Delete record published in *Watsonia* **11**: 402 (1977); specimen in **herb. A. Brewis** is *P. pusillus* L., det. C. D. Preston.]

577/21. POTAMOGETON PECTINATUS L. **43**, Rads.: Eutrophic lake, Llanbwchllyn, GR 32/12.46. D. R. Druit & I. D. Soane, 1990, det. R. G. Woods. 2nd record.

†586/1. HEMEROCALLIS FULVA (L.) L. *49, Caerns.: Ditch near Ty Mawr, Porth Neigwl, GR 23/25.28. A. P. Connolly, 1990.

†586/2. HEMEROCALLIS LILIOASPHODELUS L. *70, Cumberland: Grassy roadside south of Orton Moss, GR 35/34.54. R. E. Groom, 1989, **LANC**.

597/1. GAGEA LUTEA (L.) Ker-Gawler **75**, Ayrs.: Wooded bank of R. Girvan near Merkland, Kirkmichael, GR 26/34.07. M. Faulds, 1989, conf. A.McG. Stirling, 1990. 2nd record.

598/3. ORNITHOGALUM PYRENAICUM L. †*51, Flints.: Point of Ayr, GR 33/1.8. P. I. Morris, 1988.

605/4. JUNCUS COMPRESSUS Jacq. *77, Lanarks.: Malls Mire, Rutherglen, GR 26/60.62. J. N. Davies, 1985, **GL**, det. H. J. Noltie.

605/amb. JUNCUS AMBIGUUS Guss. **46**, Cards.: Muddy depressions in car park by beach, Ynyslas, GR 22/60.92. B.S.B.I. meeting, 1990, det. T. C. G. Rich. 2nd record.

607/6. ALLIUM OLERACEUM L. **26**, W. Suffolk: Verge of old railway track, Hadleigh, GR 62/03.41. M. Parker & F. W. Simpson, 1989. Only extant locality.

†607/7. ALLIUM CARINATUM L. *__49__, Caerns.: Grassy roadside verge 3 km south of Conway, GR 23/77.74. R. Lewis, 1988, **NMW**.

607/8. ALLIUM SCHOENOPRASUM L. †*__39__, Staffs.: Base-rich spoil of old industrial site, Wood Common, Pelsall, GR 43/01.04. J. P. Martin, 1990.

†607/10. ALLIUM TRIQUETRUM L. *__25__, E. Suffolk: Under trees by footpath, Waldringfield, GR 62/28.44. P. Furze, 1989, **IPS**, det. E. J. Clement.

†607/11. ALLIUM PARADOXUM (Bieb.) G. Don *__69__, Westmorland: Wooded river bank, R. Rothay, Ambleside, GR 35/37.04. A. Franks, 1989, **LANC**.

616/3. IRIS FOETIDISSIMA L. †*__69__, Westmorland: Roadside verge, Prince's Way, Heversham, GR 34/49.83. C. E. Wild, 1990, **LANC**.

†618/1. CROCUS NUDIFLORUS Sm. *__73__, Kirkcudbrights: Gravelly island in R. Cree near Creebridge, GR 25/41.65. O. M. Stewart, 1988.

†620/pot. CROCOSMIA POTTSII (Baker) N. E. Brown *__73__, Kirkcudbrights.: Embankment by R. Dee below Glenlochar Dam, GR 25/73.64. O. M. Stewart, 1982, **E.** Bank of R. Cree below Minnigaff, GR 25/41.65. O. M. Stewart, 1982. 1st and 2nd records.

627/1. SPIRANTHES SPIRALIS (L.) Chevall. *__42__, Brecs.: Old lawn, Llangattock, GR 32/21.18. S. Sankey-Barker, 1989.

627/3. SPIRANTHES ROMANZOFFIANA Cham. **103**, Mid Ebudes: Partially drained bog, Mornish, GR 17/3.5. F. Horsman, 1990. 1st Mull record.

635/1. COELOGLOSSUM VIRIDE (L.) Hartman **25**, E. Suffolk: Meadow on boulder-clay, Winks Meadow, Metfield, GR 62/30.79. E. Krutysza, 1990, det. M. N. Sanford. Only extant locality.

636/1b. GYMNADENIA CONOPSEA subsp. DENSIFLORA (Wahlenb.) G. Camus, Bergon & A. Camus *__105__, W. Ross: Marsh near Mellon Charles, GR 18/8.9. A. G. Kenneth, M. R. Lowe & D. J. Tennant, 1984, **E**, det. D. J. T. & R. H. Roberts.

642/7. ORCHIS MASCULA (L.) L. **72**, Dumfriess.: Ledges above Tail Burn near Loch Skeen, GR 36/18.15. R. W. M. Corner, 1989. Only extant locality.

643/1 × 3. DACTYLORHIZA FUCHSII (Druce) Soó × D. INCARNATA (L.) Soó *__41__, Glam.: Kenfig Burrows, GR 31/79.81. D. C. Lang, 1990.

643/1 × 3b × 7. DACTYLORHIZA FUCHSII (Druce) Soó × D. INCARNATA subsp. PULCHELLA (Druce) Soó × D. TRAUNSTEINERI (Sauter) Soó *__62__, N. E. Yorks.: Marsh near Thornton Dale, GR 44/8.8. F. Horsman, 1989.

643/1 × 4. DACTYLORHIZA FUCHSII (Druce) Soó × D. PRAETERMISSA (Druce) Soó *__46__, Cards.: Moist pasture above Plas Cwmcynfelin, Llangorwen, GR 22/60.83. A. P. Fowles, 1989, det. D. C. Lang.

643/2b × 4. DACTYLORHIZA MACULATA subsp. ERICETORUM (E. F. Linton) P. F. Hunt & Summerhayes × D. PRAETERMISSA (Druce) Soó *__42__, Brecs.: Marshy meadow near Llangorse Lake, GR 32/12.26. M. Porter, 1990.

643/2b × 5 maj. DACTYLORHIZA MACULATA subsp. ERICETORUM (E. F. Linton) P. F. Hunt & Summerhayes × D. PURPURELLA subsp. MAJALIFORMIS E. Nelson *__110__, Outer Hebrides: Coastal marsh, Borve, S. Harris, GR 18/02.94. A. G. Kenneth & D. J. Tennant, 1985, **herb. D.J.T.**, det. D. J. T. & R. H. Roberts.

643/3c × 5 maj. DACTYLORHIZA INCARNATA subsp. COCCINEA (Pugsley) Soó × D. PURPURELLA subsp. MAJALIFORMIS E. Nelson *110, Outer Hebrides: Coastal marsh, Borve, S. Harris, GR 18/02.94. A. G. Kenneth & D. J. Tennant, 1985, **herb. D.J.T.**, det. D. J. T. & R. H. Roberts.

643/4 × 5. DACTYLORHIZA PRAETERMISSA (Druce) Soó × D. PURPURELLA (T. & T. A. Stephenson) Soó *64, Mid-W. Yorks.: Calcareous area in Lawkland Moss, GR 34/76.66. F. Horsman, 1990.

643/5. DACTYLORHIZA PURPURELLA (T. & T. A. Stephenson) Soó *41, Glam.: Dune slacks, Kenfig Burrows, GR 21/79.81. D. C. Lang, 1990.

643/5 maj. DACTYLORHIZA PURPURELLA subsp. MAJALIFORMIS E. Nelson *105, W. Ross: Marsh near Mellon Charles, GR 18/8.9. A. G. Kenneth, M. R. Lowe & D. J. Tennant, 1984, **herb. D.J.T.**, det. D. J. T. & R. H. Roberts. *110, Outer Hebrides: Coastal marsh, Northton, S. Harris, GR 08/99.90. Coastal marsh, Borve, S. Harris, GR 18/02.94. Both A. G. Kenneth, M. R. Lowe & D. J. Tennant, 1985, **herb. D.J.T.**, det. D. J. T. & R. H. Roberts. 1st and 2nd records (plant previously reported as *D. majalis* subsp. *occidentalis* (Pugsley) P. D. Sell).

643/7. DACTYLORHIZA TRAUNSTEINERI (Sauter) Soó *45, Pembs.: Flush in calcareous fen, Castlemartin Corse, GR 11/89.99. J. Donovan, S. B. Evans & D. C. Lang, 1990. 1st Welsh record.

643/5 × 636/1. DACTYLORHIZA PURPURELLA (T. & T. A. Stephenson) Soó × GYMNADENIA CONOPSEA (L.) R. Br. *105, W. Ross: Wet ditch near Mellon Charles, GR 18/8.9. A. G. Kenneth, M. R. Lowe & D. J. Tennant, 1984, **E**, det. D. J. T. & R. H. Roberts.

†648/1. LYSICHITON AMERICANUS Hultén & St John *35, Mons.: Ditch in wood, Llanarth Fawr, GR 32/36.08. C. Titcombe, 1990.

654/2. ERIOPHORUM GRACILE Roth 41, Glam.: Fen, Pant-y-Saes Fen near Neath, GR 21/71.94. C. R. Hipkin, 1990. 2nd record.

654/3. ERIOPHORUM LATIFOLIUM Hoppe 50, Denbs.: Marshy field, Graianrhyd, GR 33/20.54. J. A. Green, 1989. 1st record since 1830.

655/12. ELEOGITON FLUITANS (L.) Link 61, S. E. Yorks.: Dike c. 1·5 miles west of Thornton, GR 44/72.45. T. E. Dixon, 1990. Only extant locality.

657/1. BLYSMUS COMPRESSUS (L.) Panzer & Link *42, Brecs.: Small marsh by tufa outcrop, Hay-on-Wye, GR 32/2.3. M. Porter, 1989, **NMW**. 1st record, and only extant Welsh locality.

658/1. CYPERUS LONGUS L. †35, Mons.: Pond margin, Kilgwrrwg, GR 31/47.97. T. G. Evans, 1990, **herb. T.G.E.** Only extant locality.

663/16 × 17. CAREX ROSTRATA Stokes × C. VESICARIA L. *47, Monts.: With *C. rostrata* at marshy edge of lake, Maesmawr Hall, GR 33/1.0. P. M. Benoit, 1989, **NMW**, det. A. O. Chater & A. C. Jermy.

663/21 × 20. CAREX ACUTIFORMIS Ehrh. × C. RIPARIA Curtis *25, E. Suffolk: Framlingham Mere, GR 62/28.63. A. C. Jermy, 1990.

663/47 × 21. CAREX ACUTA L. × C. ACUTIFORMIS Ehrh. *25, E. Suffolk: Framlingham Mere, GR 62/28.63. A. C. Jermy, 1990.

663/23. CAREX STRIGOSA Hudson 69, Westmorland: Clayey drainage channel, High Wood, Askham-in-Furness, GR 34/20.76. P. Burton, 1989, **LANC**. 1st post-1930 record.

663/24. CAREX PALLESCENS L. *81, Berwicks.: Wet meadow, Leescleugh Burn, GR 36/74.52. M. E. Braithwaite, 1990, **herb. M.E.B.** 1st record since 1880. Flushed grassland, Wellcleugh Burn, GR 36/73.52. M. E. Braithwaite, 1990. 2nd extant locality.

663/28. CAREX LIMOSA L. 50, Denbs.: Soligenous flush, Llansannan, GR 23/93.61. P. Day, 1989, det. A. O. Chater. 2nd record.

663/52. CAREX BIGELOWII Torrey ex Schweinitz *47, Monts.: Moel Sych, GR 33/0.3. A. P. & R. A. Dawes, 1990, **NMW**, det. P. M. Benoit. Confirms hitherto disregarded record from same locality. 72, Dumfriess.: Moffat Hills, GR 36/1.1. R. W. M. Corner, 1989. 2nd extant locality.

663/54 × 71. Carex paniculata L. × C. remota L. *35, Mons.: With parents in woodland flush, Cwm Merddog, GR 32/18.06. R. Fraser, 1990, **herb. T. G. Evans**, det. A. O. Chater. *47, Monts.: With parents in marshy oak-birch woodland near Penegoes, GR 23/7.0. A. Morton, S. Grasse & P. M. Benoit, 1990, **NMW**, det. A. O. Chater & A. C. Jermy. *96, Easterness: Swamp, Loch Battan, GR 28/53.38. D. Gilbert, 1988, **herb. N.C.C. Inverness**, det. A. C. Jermy.

663/57. Carex otrubae Podp. *77, Lanarks.: Damp grassland, Garthamlock, Glasgow, GR 26/66.66. K. Watson, 1986, **GL**. 1st localised record.

†663/59. Carex vulpinoidea Michx 77, Lanarks.: Waste ground, Hallside near Cambuslang, GR 26/66.60. J. H. Dickson, 1989, **GL**. 2nd record.

663/61. Carex arenaria L. †*47, Monts.: Railway ballast, Dovey Junction Station, GR 22/6.9. P. M. Benoit, 1989, **NMW**.

663/69. Carex elongata L. 12, N. Hants.: Swampy area under *Salix* by R. Blackwater, Ash, GR 41/88.51. C. R. Hall, 1990, **herb. A. Brewis**, det. F. Rose. Only extant locality.

670/2 × 1. Festuca arundinacea Schreber × F. pratensis Hudson *38, Warks.: Meadow, Moreton Morrell, GR 42/30.55. J. C. Bowra, 1990, **WAR**, det. P. J. O. Trist.

670/2 × 3. Festuca arundinacea Schreber × F. gigantea (L.) Vill. *42, Brecs.: Shaded margin of pool, Glasbury, GR 32/18.40. M. Porter, 1990, **NMW**.

†670/5. Festuca heterophylla Lam. 35, Mons.: Woodland edge, The Hill, Abergavenny, GR 32/29.15. R. Fraser, 1987, **NMW**, det. R. F. & T. G. Evans. 2nd vice-county and Welsh records. *73, Kirkcudbrights.: Grassy edge of Marbreck Burn, Burnfoot, GR 25/59.92. O. M. Stewart, 1989, **E**, det. P. J. O. Trist. Edge of roadside wood, Garroch, GR 25/59.80. O. M. Stewart, 1990, **E**. 1st and 2nd records.

670/6b. Festuca nigrescens Lam. subsp. nigrescens 2, E. Cornwall: Hedgebank, West Looe, GR 20/23.52. R. W. Gould, 1989, **LTR**, det. A.-K. Al-Bermani. 1st record since 1926.

673/5. Puccinellia rupestris (With.) Fernald & Weatherby 53, S. Lincs.: Track behind sea wall between R. Ouse and R. Nene, GR 53/51.26. S. J. Leach, 1989. 2nd record.

674/2. Desmazeria marina (L.) Druce *47, Monts.: Dovey Junction Station, GR 22/6.9. P. M. Benoit, 1989, **NMW**.

667/1 aqu. Catabrosa aquatica L. subsp. aquatica *75, Ayrs.: Near Ardrossan, GR 26/2.4. W. Barclay, 1988, **E**. Near Burnfoot, Bennane, GR 25/11.88. D. Counsell, 1990, **herb. A. McG. Stirling**, det. A. McG. S. 1st and 2nd records.

667/1 min. Catabrosa aquatica subsp. minor (Bab.) F. Perring & Sell *75, Ayrs.: Seamill, West Kilbride, GR 26/2.4. R. H. Meldrum, 1889, **E**, det. A.McG. Stirling.

†680/3. Briza maxima L. *75, Ayrs.: Foreshore, Ballantrae, GR 25/08.82. J. G. Michie, 1960, **E**. Quarry, Noddsdale, Largs, GR 26/22.64. A. McG. Stirling, 1989, **E**. 1st and 2nd records.

681/2. Melica nutans L. 93, N. Aberdeen: Gorge, Gordonsburn, GR 38/47.38. D. Welch, 1989, **ABD**. 1st record since c. 1765.

†683/4. Bromus inermis Leyss. *67, S. Northumb.: Reclaimed pit heap near Rising Sun Farm, GR 45/29.68. D. Mitchell, 1990, **herb. G.A. Swan**, det. P. J. O. Trist.

†683/7. Bromus diandrus Roth *77, Lanarks.: Pavement, Cadder, GR 26/61.72. J. H. Dickson, 1989, **GL**. More abundant in 1990. Foot of wall, Meadowside, Glasgow, GR 26/55.66. P.Macpherson, 1989, **herb. P.M.**, det. P. Smith. Still present in 1990. 1st and 2nd records. *93, N. Aberdeen: Set-aside field, Pitcaple, GR 38/71.24. D. Welch, 1990, **ABD**.

†683/9. Bromus tectorum L. 11, S. Hants.: By new road, West End, Southampton, GR 41/48.14. P. D. Stanley, 1990, **herb. R.P. Bowman**. 2nd extant locality. *42, Brecs.: Garden weed, Llangynidr, GR 32/16.19. M. Porter, 1988, det. T. A. Cope.

†683/19. BROMUS CARINATUS Hooker & Arnott *28, W. Norfolk: Verge of track, Feltwell, GR 52/67.89. R. Tofts, 1989. Verge of green lane, Methwold, GR 52/73.91. R. Tofts & K. A. & G. Beckett, 1989. 1st and 2nd records, both det. P. J. O. Trist. **51**, Flints.: Foot of church wall, Rhuddlan, GR 33/02.78. T. C. G. Rich, 1987, det. T. A. Cope. 2nd record.

685/4 × 3. ELYMUS PYCNANTHUS (Godron) Melderis × E. REPENS (L.) Gould *46, Cards.: Edge of golf course, Ynys-las, GR 22/60.93. A. O. Chater, 1990, **K**, det. T. A. Cope.

†697/3. AIRA CARYOPHYLLEA subsp. MULTICULMIS (Dumort.) Bonnier & Layens *77, Lanarks.: Bare ground, Shieldhall, GR 26/53.66. Sandy ground, Westburn, Cambuslang, GR 26/65.60. Both P. Macpherson, 1989, **herb. P.M.**, det. P. J. O. Trist. 1st and 2nd records.

700/3. CALAMAGROSTIS STRICTA (Timm.) Koeler **75**, Ayrs.: Wetlands by R. Doon between Waterside and Dalmellington, GR 26/45.07. D. Counsell, 1990, **E**, det. A. McG. Stirling. 2nd record.

701/4. AGROSTIS GIGANTEA Roth **81**, Berwicks.: Arable land near Dunslaw Farm, GR 36/79.55. M. E. Braithwaite, 1990, det. R. W. M. Corner. 2nd record.

701/sca. AGROSTIS SCABRA Willd. *46, Cards.: Graveyard, Llangwyryfon, GR 22/59.70. P. Macpherson, 1987, **NMW**, det. C. A. Stace. 2nd Welsh record.

708/4. ALOPECURUS AEQUALIS Sobol. **5**, S. Somerset: Drying sand at edge of Hawkridge Reservoir, GR 31/20.35. and 20.36. P. R. Green, 1990. 2nd record.

708/4 × 3. ALOPECURUS AEQUALIS Sobol. × A. GENICULATUS L. *24, Bucks.: Lakeside, Tiddenfoot, Leighton Linslade, GR 42/91.23. C. M. Dony, 1986, **LTN**, det. C. A. Stace & P. J. O. Trist.

708/5 × 3. ALOPECURUS BULBOSUS Gouan × A. GENICULATUS L. *5, S. Somerset: Fixed dunes, Wall Common, GR 31/26.45. P. Harmes, 1990, det. A. C. Leslie. *54, N. Lincs.: Old saltmarsh, now grazed by ponies, Winteringham Haven, GR 44/93.23. W. Earnshaw, 1989, det. P. J. O. Trist.

708/6. ALOPECURUS ALPINUS Sm. **72**, Dumfriess.: Flushed ledges, White Coomb, GR 36/1.1. R. W. M. Corner, 1989. Only extant locality.

711/1. HIEROCHLOE ODORATA (L.) Beauv. **109**, Caithness: Sand dune, Dunnet Sands, GR 29/21.70. J. K. Butler, 1978, **E**, det. S. M. Walters. 2nd record.

714/2. PARAPHOLIS INCURVA (L.) C. E. Hubbard **5**, S. Somerset: By pool on sandy beach, Greenaleigh, GR 21/95.48. C. J. Giddens, 1990. 2nd record. **54**, N. Lincs.: Sand on top of sea defences, Trusthorpe, GR 53/51.83. J. Southey, 1989. 2nd record.

Book Reviews

John Lightfoot: his work and travels, with a biographical introduction and a catalogue of the Lightfoot Herbarium. J. K. Bowden. Pp. vi + 255, illust. The Bentham-Moxon Trust, Kew, and Hunt Institute for Botanical Documentation, Pittsburgh. 1989. Price £16 (ISBN 0–913196–51–7).

The contribution made by the English clergy to the development of descriptive British natural history, especially during the eighteenth and nineteenth centuries, was nothing short of phenomenal. The Reverend Gilbert White (1720–1793) is perhaps the most famous, the Reverend William Kirkby (1759–1850), father of British entomology, not far behind, and here, of course, is Whites's friend, the Reverend John Lightfoot, M.A., F.R.S., F.L.S. (1735–1788), who is the subject of a new biography by Jean Bowden. Lightfoot's reputation is founded upon his botany and conchology: his *Flora Scotica*, 1777 and the *Catalogue of the Portland Museum*, 1786, being the somewhat slender published evidence of his activities. It is through the statements of his many correspondents, however, that a broader picture unfolds of his wide-ranging knowledge, his unselfish help to others, and the pursuit of scholarly excellence. Lightfoot's close friend Thomas Pennant (1725–1798) summed things up: "He was an excellent scholar in many branches of literature; but after the study of his profession, he addicted himself chiefly to that of botany and conchyliologie [sic]. He excelled in both."

Not much has been written hitherto about the life of John Lightfoot. Thomas Pennant, zoologist, traveller, and correspondent of many of the eminent figures of natural philosophy in the eighteenth century, knew Lightfoot well. In the second edition of *Flora Scotica*, 1789, published just after Lightfoot's premature death, Pennant included an additional preface entitled 'Some account of the author of this work.' In 1819 James Edward Smith's short biography appeared in Rees' *Cyclopaedia*, and, apart from a short obituary notice in *The Gentleman's Magazine* in 1788, that is all.

John Lightfoot was born on 9 December 1735 at Newent in the Forest of Dean, about 13 km from Gloucester, the son of a gentleman farmer. Little is known of his upbringing until 1753, when at the age of seventeen he entered Pembroke College, Oxford. He graduated in 1756, and proceeded to an M.A. in 1766. After taking holy orders, he was appointed curate at Colnbrook, Middlesex, sometime between 1756 and 1762. In 1765 Lord Chancellor Northington gave him the living of Shelden, near Alton in Hampshire, a stone's throw from Gilbert White's parish of Selborne, which he held until 1777. He married Matilda Raynes, daughter of a wealthy mill-owner of Uxbridge, Middlesex in 1780, when he was nearly 45 and she just 20. They had three daughters and two sons, although one daughter died before the age of two.

Like so many churchmen, Lightfoot used his spare time for the observation of nature, study and research. It was almost certainly as a result of this that in 1767 he was chosen, at the age of 31, to become Chaplain to the Dowager Duchess of Portland (the second Duke having died in 1762). Lady Margaret Cavendish Bentinck, only daughter and heiress of the second Earl of Oxford, was the leading patroness of the natural sciences in England during her lifetime. Sir Joseph Banks (1743–1820) and Daniel Solander (1733–1782), fresh from their triumphant circumnavigation in 1768–1771 with Cook, were frequent visitors to the Dowager Duchess's great house at Bulstrode in Buckinghamshire. The focus of attention there was her natural history collection on which she lavished most of her fortune and energy. On the Dowager Duchess's death in 1785, Lightfoot was mainly responsible for drawing up the sale catalogue, the well-known *Catalogue of the Portland Museum*, 1786.

Lightfoot's travels to Scotland (1772) and Wales (1773) were undertaken at the instigation of Thomas Pennant and Sir Joseph Banks respectively. Pennant had early recognised the excellence of Lightfoot's botany and invited him to be his companion on a five-month tour in Scotland, including the Hebrides, for the purpose of observing and working up the botany of a region little studied in that respect. Pennant strongly encouraged Lightfoot to prepare the work for publication and actually provided financial support for *Flora scotica* which came out in 1777. It was the first Flora of the north of Britain in which Linnaean binomials were used. However, during Lightfoot's lifetime

Flora scotica was heavily criticised by those perhaps envious of Pennant's financial support and it was not the success it deserved to be. Lightfoot's tour in Wales with Banks did not result in a publication.

Jean Bowden's new biography, written whilst she was employed at Kew, is based on Lightfoot's letters to his friends and associates, especially the Dowager Duchess of Portland, Sir Joseph Banks, Sir John Cullum, Thomas Pennant, William Curtis and Gilbert White. She has scoured libraries and record offices for material, photocopies of which have been deposited in the Kew Archives. By using extensive and numerous quotes from this correspondence, Ms Bowden has tackled the organisation of the biography in an unconventional way. A long introduction outlining Lightfoot's life precedes sections devoted to the principal events – the tours in Scotland, Wales, Devon and Cornwall, Portland Catalogue and British Flora – using quotations to chart a step-by-step account of itineraries and activities. A final section consists of a Catalogue of the Lightfoot Herbarium at Kew, and five Appendices.

The Catalogue of the Lightfoot Herbarium comprises, at 90 pages, over a third of the volume. With the exception of modern identifications, verified by expert helpers, summary counts of Lightfoot's folders and sheets and any attributions or comments, all the information in the entries is taken directly from the writing on the folders or sheets. The Catalogue is extraordinarily detailed. Its ease of use would have been enhanced by inclusion in the index of names used in it. This point of criticism applies also to names which appear in the Appendices. The index is rather basic and reduces usefulness of the biography for quick-reference purposes.

Scholarship in biographical study can result in exceptional factual accuracy but also a loss of the readability. Here the over-use of quotations from newly-revealed sources becomes almost an irritation. The reader longs for some analysis and speculation to chew upon. At least footnotes have been omitted though, and all references are gathered together into three pages at the end. Typography and lay-out are workmanlike, but the nine illustrations have printed poorly in the text. The map of Scotland showing Lightfoot's itinerary requires the use of a magnifying glass.

The overwhelming impression of this biography is that much new light is shed on John Lightfoot's natural history activities through recently uncovered manuscript sources. For botanists, the Catalogue of his herbarium, linked with a detailed investigation of collecting localities, will provide much essential information about the British flora. For the student of biography, Ms Bowden's study fills another gap in the who's who of eighteenth century British natural history.

R. E. R. Banks

The botanist in Berwickshire. M. E. Braithwaite & D. G. Long. Pp. 111, with map. The Berwickshire Naturalists Club. 1990. Price £6 (ISBN 0–9516434–0–1)

This attractively produced work is an excellent example of the type of local botanical guide now becoming popular, providing the reader with something more than a basic check list though falling short of a comprehensive flora. The soft cover is attractively designed, incorporating a very professional colour illustration of Rock Rose, and the size – a slim 20 × 15 cm – makes for easy portability. The inclusion of a bryological section is somewhat unconventional and there may be differing views as to the desirability of this format, but in an economically priced work there is much to commend the combination.

An introductory section sets out the format and scope of the contents and includes an historical account of botanical recording in the county. The order of species and their scientific names follows the 3rd edition of Clapham, Tutin & Warburg's *Excursion Flora* and the common names are according to *English Names of Wild Flowers*, 2nd edition. Local and possibly unfamiliar names are rarely used. The section on flowering plants and ferns by Michael Braithwaite (B.S.B.I. Recorder for v.c 81) is preceded by an overview of the flora based on the principal habitat types found in the county, indicating their botanical features and the changes which have taken place over the years. A statistical summary of the native and introduced flora indicates its composition in terms of species, subspecies, microspecies and hybrids.

The recorded taxa, past and present, total 1151, of which 946 are known to occur at the present day. The check list which follows provides basic information for each species, ranging from a simple

indication of relative abundance in the case of the more common plants, to more explicit notes including recording dates and sites for the more interesting or localised species. Conventional symbols indicate non-native species and those considered no longer present. Rather unconventionally an indication is also given of species for which there is no record, but which might be expected in view of their national distribution. A useful gazetteer assists the user to identify many of the localities mentioned in the text, and there is a short bibliography. Readers may find the lack of a comprehensive index inconvenient. Only the genera are included, presumably in the interests of space-saving. For the convenience of those more familiar with common names there is a table indexing the families of flowering plants and ferns, but the value of this is somewhat reduced by its not being listed alphabetically.

Of the bryological section, which is by David Long of the Royal Botanic Garden, Edinburgh, and will no doubt be suitably reviewed elsewhere, it is only necessary to say that this is very comprehensive and follows the same format of overview followed by a check list.

The authors of *The botanist in Berwickshire* are to be commended for the production of this useful volume which should prove a popular guide to the flora of the area.

A. McG. Stirling

Sussex plant atlas: selected supplement. M. Briggs. Pp. 32, with introductory notes and 37 distribution maps. Booth Museum of Natural History, Brighton. 1990. Price £3.50 (ISBN 0–948723–14–9).

This book is intended to be used in conjunction with the *Sussex plant atlas* published by P.C. Hall in 1980 (see review by Rose in *Watsonia* **13**: 353–354, 1981). It has the same format and the same attractive cover. It is to be hoped that the colour reproduction of the latter is not so poor on all copies as it is on mine.

The book consists of a selection of records made by members of the Sussex Botanical Recording Society from 1979 to 1988. Only those records for which the more recent information adds significantly to the *Plant Atlas* have been included. The brief text is interesting and informative. It includes corrections of errors published in the *Atlas*, effects of the 1987 storm and sites of deliberate introduction of native species. There are some enviable new county records and rediscoveries. Those plants which Francis Rose considered under-recorded in his review of the *Atlas* have clearly been chased up and a more comprehensive distribution pattern results. I would have thought that some of these species are still under-recorded, but perhaps Sussex is fortunate and its ponds and waterways are not disappearing under that unwelcome trio: *Crassula helmsii, Lemna minuscula* and *Elodea nuttallii*. Clearly no-one except the author was interested in looking for further specimens of *Prunus* × *fruticans*.

A list of aliens and adventives additional to those in the *Atlas* is given. It is surprising that this does not include the well established colony of *Tropaeolum speciosum* at Wivelsfield Green. With the assistance of Jenny Moore of the Natural History Museum, an account has been given of the Sussex Charophytes, with tetrad maps for four of the species.

Owners of the *Sussex plant atlas* will need a copy of this *Supplement* to bring their botanical knowledge of the county up to date.

J. E. Smith

The Davis & Hedge Festschrift. Edited by Kit Tan, assisted by R. R. Mill & T. S. Elias. Edinburgh University Press. 1989. Pp. xxvi + 351; 1 colour plate and many b/w illustations. Price £47.50 (ISBN 0–85224–638–2).

The subtitle of this book, "Plant Taxonomy, Phytogeography and Related Subjects", describes not only the scope of the 25 commissioned articles but also the life-long research goals of the two distinguished Edinburgh botanists in whose honour it was published. It starts with a biographical

sketch of Peter H. Davis ('P. D.' to his friends and colleagues), a list of his publications, an illustrated description of *Biarum davisii* and an even briefer account of the career of Ian C. Hedge with an extensive bibliography. Both men have a lifetime's involvement with taxonomic botany at Edinburgh, one as a University lecturer and professor as well as editor of the *Flora of Turkey*, the other as a taxonomist and curator of the herbarium at the Royal Botanic Gardens and contributor to most of the post-war Floras of south-west Asia.

It is appropriate that south-west Asian botany should be the theme of most of the authors selected by Kit Tan, all of whom have had a close professional relationship with Davis and Hedge. One contribution, Jennifer Lamond's 'Plantsmen and Pottery', reflects the private interests of Peter Davis as a collector of ceramics, while Karl-Heinz Rechinger's account of 'Fifty years of botanical research in the *Flora Iranica* area (1937–1987)' is a *tour de force* which should be read by anyone contemplating botanical field-work in the region. Rupert Barneby's account of 'A far-rolling stone' deals with the bizarre story of a 'dimpled egg' excavated in a paddock in Leicestershire which proved to be the seed of a Brazilian rain-forest liana; it reminds us that the flora of the British Isles is full of surprises.

There is little of purely local interest in this book; it is hard to see who might buy a personal copy, since its price of nearly £50 represents a major outlay for what is a rather eclectic range of topics. Academic libraries, on the other hand, will find its articles to be much sought after and will need to buy it. It is a worthy momento to mark the 70th and 60th birthdays of two of Edinburgh's outstanding botanists, who are widely respected for their taxonomic expertise and judgement; it also displays the high standards of editorship for which they are known.

J. R. Edmondson

Plants for people. A. Lewington. Pp. vii + 232; lavishly illustrated. Natural History Museum Publications, London. 1990. Price £19.95 (ISBN 0–565–01094–8).

Plants for people is exactly as its title suggests. Each one of the seven chapters lucidly describes the botanical basis of our daily lives: plants that cover us; plants that feed us; plants that protect us; plants that cure us; plants that transport us and plants that entertain us. A purist would categorize the book as Economic or Ethno-Botany, but these descriptions would fail to do justice to the highly readable, informative and entertaining nature of its contents.

Plants for people does not become bogged down in any one aspect of plants or their uses, but skilfully takes the reader through the scientific aspects of plants and their extracts, to why they are used as they are and at what cost both in financial and environmental terms.

The book is as up to date as it could be, telling us that a chemical (castanospermine) from the seed of an Australian evergreen tree called the Moreton Bay Chestnut (*Castanospermum australe*) has recently been isolated and found to have a dramatic effect on the AIDS virus HIV. The historical development of plant use is also well presented. The Egyptians used plant oils and fragrant flowers in their ablutions. The Romans were aware of the disinfectant properties of Lavender. Indeed, its scientific name, *Lavandula*, is derived from the Latin 'lavare' meaning to wash. "Ring a ring of roses, a pocket full of posies" testifies to the once held belief that carrying a posy of fragrant flowers would ward off disease.

The development and context of plant use is by no means confined to the western or Classical world. Some of the uses made of plants and their by-products by indigenous peoples worldwide have also been the subject of research. Colouring the skin, particularly the face, with patterns of pigments conveys important messages about the wearer be they from Burma, New Guinea, Japan, Cameroon or the Indian sub-continent.

The main text guides the reader through the information at an easy but attention-holding pace. Every second page presents a profile of a particular plant which gives a little more in-depth information about it, the areas in which it is found and the uses to which it has been put by people.

As a book it is well constructed and any reader will appreciate the unpretentious language, the excellent and numerous colour plates and illustrations and the excellent but over-done design. It is also gratifying to find a comprehensive index.

In her Foreword to *Plants for people*, Anita Roddick expresses the hope that when people read

this book they will gain a renewed appreciation of what plants do for people the world over. In that it succeeds. It is not just another contribution to environmental friendship. It is a book whose literary yet scientific approach gradually reveals the fundamental part played by plants in our various lifestyles and makes the reader consider and realise the implications of this relationship. It neither hesitates in nor apologises for telling the facts as they are. It gives everyone, be they scholar or amateur, an opportunity to reflect upon the impact they themselves make on the environment by doing something as simple as brushing their teeth.

The Royal Botanic Gardens, Kew, the Natural History Museum and, above all, Anna Lewington have provided their public with a worthwhile and informative read.

E. I. KWASNIK

A guide to some difficult plants. Edited by E. Norman. Pp. 131 with numerous line drawings and keys. Wild Flower Society, Loughborough. 1990. Price £6. Available from 68 Outwoods Road, Loughborough, Leics.

This booklet usefully gathers together several series of articles from the *Wild Flower Society Magazine* from 1973–88, published by the generosity of the mother of Christine Hibbert, a member who died too young. The authors are all experts in their fields and although the chatty nature of the articles occasionally gives a feeling of talking down, they are packed with useful facts to aid all field botanists.

John Mason's guide to bird-seed aliens is full of drawings you will find elsewhere in British books, with keys and salient features for a wide range of species. It makes one wish that rubbish-tips were as rich as they used to be. Willows are comprehensively covered by the Howitts, with hints from a lifetime's experience augmented by the first of Olga Stewart's excellent drawings. Alpine willows are not considered. Alan Silverside takes us skilfully through yellow Compositae, even tackling *Hieracium* and *Taraxacum* (inevitably the least useful part of the book). Next, *Juncus* and *Luzula* by Dr Tom Cope are dealt with in some depth including *J. subulatus*, *J. planifolius*, the *J. bufonius* splits and some hybrids. But I feel you would look in vain for *J. capitatus* on Anglesey these days. The seed characters of *L. campestris* and *L. multiflora* are not mentioned. Norman Robson gives a fascinating discourse on *Hypericum*. I had not realised that *androsaemum* signified 'man's blood' after the red sap of Tutsan. The genus is placed in its world context which helps to explain several puzzles.

Major-General Turpin deals with heathers, calling on a wide range of sources listed at the end. Considerable detail about all species and hybrids is given and we are told how to spot and conclusively identify *Erica* × *watsonii (tetralix* × *ciliaris*) which the inevitable visitors to Dorset would value. Comments about the 47 variants of *Calluna* described make one want to know more! Finally, Tim Rich gives a foretaste of his Crucifer Handbook in a chapter on "nasty" yellow crucifers. Few people would not find useful his forthright comments on which books not to use and the practical hints on how and when to determine his favourite plants. 'All You Want to Know About Yellow Crucifers' might be an alternative title.

So, if you are active in the field or want your appetite stimulating, here is a very good and cheap booklet to help you. Buy it before it is out of print.

G. M. KAY

Atlas of the British flora. Edited by F. H. Perring & S. M. Walters. Pp. xxiv + 444. Botanical Society of the British Isles, London. 1990. Price £20 (ISBN 0–90115–819–4).

The *Atlas* has had a long history; it was first published by Thomas Nelson and Sons in 1962 and reprinted only a year later, such was the importance and demand. The work was originally reviewed by D. H. Kent in *Watsonia* **5**: 396–397 (1963). A second edition was produced by Epworth Press in 1976 with two more reprints before a third edition in 1982. The changes between the editions are rather less dramatic than might be supposed, for the second edition only updates the rare species.

The completion of the *Red Data Book of British Vascular Plants* after seven years of work on some 350 of our rarest species allowed these maps, where necessary, to be updated and elsewhere, only obvious errors corrected. Any maps which were altered were given a + sign to the right of the species number in the inset. Similarly, maps altered in the third edition were given an * symbol. Sadly, even the Pteridophytes were not updated by using the more recent maps in the *Atlas of ferns of the British Isles* (1978) edited by Jermy, Arnold, Farrell & Perring, and the under-recording of *Primula vulgaris* in Ireland due to an administrative error, subsequently rectified in the *Critical supplement*, has again been overlooked.

This new reprint of the third edition of the *Atlas* is in a much smaller (and hence more convenient and portable) size, c. 35.0 × 17.5 cm. The work can at last be taken off the table and into the car – even carried in the ruck-sack. The maps are clear and usable. The original transparent overlays (six, each with two maps) of the first and third editions have been reproduced as three ordinary pages. Sadly, in an attempt to keep the cost of the reprint reasonable the reader is left to produce his or her own transparent overlays. However, there is one very important addition: an Index and Bibliography. This has been prepared by C. D. Preston in his usual meticulous and careful way. This welcome addition enables the user to check if a more recent (1962–1989) and up-to-date map has been published elsewhere. We are especially grateful to him for his efforts; for these nine pages alone the work is worth buying.

S. L. Jury

Guide des fougères et plantes alliées. R. Prelli. Pp. viii + 232, illustrated. Editions Lechevalier, Paris. 1990. Price not stated (ISBN 2–720–50528–5).

This second edition of Prelli's *Guide* follows the same pattern as the first, a brief general account of the essential features of the Pteridophyta, followed by a *catalogue raisonnée* of the species to be found in France (including Corsica).

The anatomy and morphology of the pteridophytes are dealt with at an elementary level, and there is little at which to cavil. Not all fern spores however possess a perispore (as is implied). Beginners will search the spores of *Pteridium* (for example) in vain. Mention might have been made of the manner in which the gametophytes of many ferns pass through male and female phases as they develop. This feature, tending to discourage intragametophytic selfing, may be an important aspect of their population biology.

The condensed account of the fossil history of the pteridophytes is not wholly in accord with modern views, although similar will be found in some current textbooks. There is little evidence of any close relationship between *Psilotum* and *Rhynia*. Many would now doubt the relevance of the kind of heterospory seen in *Selaginella* to the evolution of seeds. The reader might assume from the text that all the fern-like fronds found in the Carboniferous were referable to ferns. Many belonged to the all-important pteridosperms (which receive no mention).

The systematic section, which is brought into line with current knowledge, forms a useful Flora. Keys are provided for the larger genera. *Asplenium* is made to include *Phyllitis* and *Ceterach*. The analysis of the probable relationships of *Dryopteris affinis, D. oreades* and *D. caucasica* (reflecting the views of Fraser-Jenkins and others) is clearly set out. The descriptions of species are frequently supported by excellent drawings, and those of many ferns by photo-silhouettes of the fronds. Unfortunately no magnifications are given. In fact, dimensions are entirely absent. "Spores smaller than in the two other sub-species" (following *Dryopteris affinis* subsp. *affinis*) is of little use for purposes of identification if no measurements are given for any form. Chromosome numbers are also conspicuously missing, although ploidy is often referred to.

According to the Introduction the *Guide* is intended for all those seeking information about the biology, ecology, evolution and classification of the Pteridophyta. Having mastered the first part of the book, it is presumably hoped that the readers will then proceed into the field to see the living representatives that France has to offer. It is a laudable aim; let us hope it succeeds.

P. R. Bell

Wild flower habitats of Hertfordshire; past, present and future. B. Sawford. Pp. xvi + 299 with 16 colour plates. Castlemead Publications, Ware, Herts. Price £18.95 (ISBN 0–948555–09–2).

This book by the Senior Keeper of the North Hertfordshire Museum's Natural History Department sets an excellent pattern that one would like to see repeated for every county in Britain. He discusses first the usual preliminaries – geology, climate and so forth – and then describes in some detail the vegetation of the county's various habitats. Finally, in a long series of appendices, which occupy almost one-third of the book, he lists the characteristic flora of these habitats. In fact he has produced a most admirable *vade-mecum* for botanists, both resident and visiting, in a county which nobody could describe as the most botanically exciting in Britain but which nevertheless has its specialities. North Hertfordshire, for instance, is the headquarters of *Bunium bulbocastanum* in England.

The habitat core of the book goes into considerable detail, describing for instance, eight woodland types in the Peterken classification plus, "recent woods and plantations", which most botanists pass swiftly by. And even Mr Sawford cannot offer a great deal more than Sycamore, Ivy, Bracken and *Urtica dioica*. However, assiduous botanists prepared to watch one plantation for several decades may also hope to log the arrival of Bluebell and Dog's Mercury. There are also analyses of eight types of grassland and ten types of wetland, with seven more sections on various man-made habitats, from arable fields to walls and churchyards. The whole enterprise, coupled with compiling the lists of characteristic plants of the various habitats, clearly entailed an enormous amount of, no doubt extremely pleasurable, field work.

The book is excellent and accurate, but could have been made even more useful by a fuller index. For instance, seeking for information on the typical habitat of *Bromus benekenii*, which I have actually seen in a Hertfordshire beechwood, I drew a blank, and quailed at checking through all the lists, or even all the likely lists. Likewise I should have welcomed more details of actual sites in the habitat section, though of course there are often good reasons for not mentioning particular sites.

A somewhat depressing Appendix is that of the 107 plants now extinct in Hertfordshire, some of them, including *Spiranthes spiralis* and *Cirsium dissectum*, having been lost as recently as the early 1980s. One advantage of publishing such lists is that it stimulates people to go and see whether the plants really are extinct – as I shall do with a local population of *Senecio fluviatilis*, which I saw in 1958, and is here stated to have become extinct c. 1960.

In future, when botanising in other counties, I shall regret not having the equivalent of Mr Sawford's book. So, more please.

R. S. R. Fitter

Wild flowers of north east Essex. T. Tarpey & J. Heath. Pp. 302, with 7 line illustrations and 659 maps. Colchester Natural History Society. 1990. Price £8 (ISBN 0–9516312–0–9).

As one who took part in the final stages of recording for Stanley Jermyn's *Flora of Essex*, published in 1974, I welcome this opportunity to find out what has been happening in my native county since then. Jermyn's flora was the culmination of many years of work and even by the time it was published it was already becoming outdated in this rapidly changing county. Unsurprisingly, this new work is often depressing reading; the phrase, "not found during our survey" appears all too frequently. Only north-eastern Essex is covered, but it is covered well.

Basically it is a report of a ten-year survey by the Colchester Natural History Society, recording on a 1 km square basis. The coverage has been remarkably thorough, with reasonable species totals from all but a handful of their 1322 squares. Maps of common species look complete, or nearly so; *Urtica dioica* has been verified from 1252 squares and *Crataegus monogyna* from 1238. The data storage (over 180,000 records) and map production have been handled by desk-top computer and should serve as an inspiration to those of us struggling to devise similar systems.

The bulk of the book consists of the accounts, sometimes brief, sometimes expanded, of all of the species recorded from the area, past or present. Most currently known species are mapped, the

maps, up to six to a page, usually being opposite the text entry. Nomenclature follows Clapham, Tutin & Warburg's *Excursion Flora of the British Isles*, 3rd edition, and synonyms are given only in the index. The introductory sections include similar 1 km square maps of surface geology, including the complex drift deposits. The accounts of the habitats are detailed and thorough and contain much on how changing management regimes have affected the flora, rarely for the better. Even popular perceptions of 'green' issues have caused problems; referring to one of the few remaining heathlands, the authors write, "there is much more to do here if the conservation message is to be interpreted as managing a habitat rather than just growing trees." On a lighter note, a mention of how lion dung may have a use in conserving woodland orchids is typical of the snippets of information to be found throughout the book.

There is much else to be found here; the remarkable linear map of *Cochearia danica* as it spreads along the central reservation of the A12 and the description of how moth collectors are threatening *Peucedanum officinale* are just two examples. Critical taxa have been carefully recorded and I was pleased to see recognition that *Poa subcaerulea* is not so rare, even in this southern county. Coverage of infraspecific taxa is, at best, sketchy, but I was interested to see the map of *Plantago major* subsp. *intermedia*, while their mapping of the two leaf shapes of *Lactuca serriola* is precisely the sort of exercise I feel should be included in such projects. The account of *Taraxacum* is substantial and up to date, though I would have liked to have seen more habitat notes. My only real criticism of the text is that there is not always a clear indication of non-native status. The text seems to indicate significantly greater losses of the native flora than is suggested by the list near the end of the book.

This is a book that should certainly be owned by every Essex botanist, but it has to interest anyone else concerned with recording schemes or conservation matters. The authors and recorders are to be congratulated.

A. J. Silverside

The biogeography of the British Isles – an introduction. P. Vincent. Pp. 315. Routledge, London. 1990. (ISBN 0–415–03470–1 hardback, 0–415–03471–× paperback).

Designed as an introductory text, this is an ambitious attempt to interest undergraduates in the interdisciplinary subject of biogeography – the study and interpretation of plant and animal distributions in geographic space. At face value such a definition appears unexceptional but, in geographical as in botanical circles, a chorological approach finds both support and opposition. By placing emphasis on patterns rather than on the processes which generate them, spatial explanations fail to disentangle the separate effects of endogenous and exogenous factors and serve rather to focus attention on the similarities in the ranges of environmental conditions at the cores and limits of distributions. In practice, Vincent achieves a reasonable balance between these competing approaches but, in consequence, the treatment of concepts and methods of enquiry is often partial and superficial. For example, although paleoecological evidence has proved useful for evaluating a number of the concepts used in the book – the causes of disjunct distributions, rates of dispersal, migration and extinction – this evidence itself needs to be applied with care. Likewise the concept of community finds no place in the discussion, even though its contribution to the history of the subject in Britain has proved to be a particularly important one. It is appropriate, for example, to examine the contribution of community ecology and vegetation description and mapping when addressing the history of nature conservation in Britain. These concepts too have played an important role in examining the impact of urban and industrial growth. Both are topics which are addressed in the latter part of the book. A partial approach means therefore, that undergraduate readers, whether in botany, ecology, environmental science or geography, are likely to need further guidance and assistance before they can adequately address the range of topics introduced here.

The strength of the book lies in its inclusion of both animal and plant distributions, of marine and terrestrial organisms and environments and in the attention given to the problem of explaining why the distribution of certain plants and animals does not extend to Ireland – the latter a particularly

useful vehicle for exploring many of the central concerns of the book. The book is very fully illustrated, has an extensive glossary and a full index. Had more attention and detail been directed to the development of a rigorous and consistent method of enquiry, then these attractive features would have ensured a wider audience than a reading of the text itself suggests.

C. M. Harrison

Obituaries

JOHN FREDERICK GUSTAV CHAPPLE
(1911—1990)

John Chapple, who died on 4 December 1990, had been no more than a name for over 40 years to all but a handful of the present generation of British botanists. A demanding and immensely successful second career in educational publishing, much of it spent overseas, had so completely taken him from his earlier interests that his obituary in *The Times* made no more than a passing and almost grudging mention of his one-time involvement in "botanical research at Oxford". Yet there was probably no one who played a more crucial role in the 1930s in holding together the Botanical Exchange Club after the death of Dr G. C. Druce and ensuring its continuance and gradual transformation into the B.S.B.I. of the post-war years.

It was to Druce that Chapple owed his entry on to the botanical stage. Born on 23 December 1911 and brought up in poverty-stricken circumstances, he was taken on by Druce as his assistant after leaving school, relieving that by then elderly and increasingly frail veteran not only of various routine curatorial chores, but even of the burden of his vasculum on their collecting trips into the field.

On his death in 1932 Druce bequeathed the larger part of his very substantial fortune to Oxford University on condition that it took over his house in the city with its very extensive herbarium and library, maintained it as an institute of taxonomic botany and appointed Chapple as the Curator, "to see that the collections are kept on good order, and to carry on as far as possible work at British Field Botany". The will further directed that the Curator "should undertake to give adequate assistance to the Botanical Society and Exchange Club, if so desired by that body". And, for good measure, there was a personal bequest to Chapple of £1000, quite a handsome sum for those days.

Unfortunately the will contained legal loopholes and became the subject of a lawsuit between the University and the Executors which dragged on and on, leaving Chapple in a position of continuing uncertainty and, for a time, acute financial difficulty (for he could not be paid out of the estate until probate was granted and that was delayed for two whole years). Only a critical £50 from the Botanical Exchange Club, which Chapple had joined in 1931, enabled him to keep afloat.

Even after the dispute was settled and the University took over as his employer, the situation remained by no means satisfactory. Taxonomy was at a very low ebb in the academic world at that period and the new institute was effectively cold-shouldered. Required nonetheless to be permanently on hand, seldom able to escape into the field, Chapple found himself frustrated and dispirited.

The one clear gainer was the B.E.C, which, thanks to Druce's forethought, acquired the services free of charge of a very efficient Executive Secretary. This proved a godsend during the prolonged and strained conversion of Druce's personal fiefdom into a learned society of ordinary character. Chapple was able to deal with much of the routine correspondence and, with the excellent knowledge he had acquired of British plants and with the Druce Herbarium on hand for reference, field many of the requests for assistance with identification which the Club felt obliged to continue to offer to meet as a major way of attracting and holding members.

By 1936 it had become increasingly apparent that no single person could cope with the range of duties that went with the Honorary Secretaryship, and on the death in that year of W. H. Pearsall, Chapple's role belatedly received official recognition and he was elected into a more narrowly-conceived version of that linchpin office. It was consequently a severe blow to the Club when, only three years later, war broke out and he was called up almost immediately.

It was a different B.E.C. and a different state of affairs at the University to which he returned in 1945. Although he resumed the Honorary Secretaryship, the Club's centre of gravity had decisively shifted to London, where its two new leading (and forceful) figures, A. J. Wilmott and J. E. Lousley, both lived and worked. At Oxford, in the meantime, taxonomy was at last beginning to revive and the Druce Herbarium to be seen as having a function within the Botany School. As a

result Chapple was placed under pressure to equip himself with an academic qualification. The prospect of the years of study that this would have entailed was hardly an appealing one; and it is little surprise that he decided to take up an offer of employment made to him some time before by his wartime commanding officer, who had formed a very high opinion of his abilities. This was K. B. Potter, a director of the old-established publishing house of Longman's Green, then just embarking on a major expansion overseas in response to the post-war boom in the English-language textbook market. This new career proved at once entirely to his taste, and before ten years were out he had been promoted to the board. Later, after the Longman Group merged with Penguin Books, his entrepreneurial flair received a culminating accolade in the shape of the chairmanship of the new joint marketing company that resulted. Despite this spectacular climb he nonetheless remained modest and self-effacing throughout, mixing little in trade circles and declining office in the Publishers' Association.

Although he had felt obliged to resign the Honorary Secretaryship on his change of career in 1947, he lingered on in the world of British botany just sufficiently long to do the B.S.B.I. (as the B.E.C. had by then become) one final, invaluable service. This was as one of the three hard-working members who constituted the historic Advertising Committee, which in the course of the 1950s was largely instrumental in increasing the size of the Society by more than half. It was a highly fitting way in which to have bowed out.

As a botanist – as opposed to a botanical administrator – he will be remembered in particular for much useful work on the floras of Berkshire and Oxfordshire, especially in the more critical groups. Anyone who consults the Fielding-Druce Herbarium today cannot but be struck by the extent and range of his contributions, both to it and to field botany locally, during that all-too-short span of years when they jointly benefited from his enthusiasm, care and expertise.

D. E. Allen

ARTHUR ROY CLAPHAM
(1904—1990)

Born on 24 May 1904, Roy Clapham was educated at the City of Norwich School. He was elected to an Open Scholarship at Downing College, Cambridge in 1922, and gained a double first class degree in Natural Sciences, specialising in Botany. His first research was also at Cambridge, under the foremost plant physiologist of the day, F. F. Blackman. In 1928 he moved to Rothamsted Agricultural Research Station as a crop physiologist, where his interests in sampling techniques and biological statistics were fostered by the renowned statistician R. A. Fisher. In 1930 he moved to Oxford University and held the post of Demonstrator in the Department of Botany until 1944. This was a period when his botanical interests were widened by contact with many leading academic botanists. One major influence was Sir A. G. Tansley, the great plant ecologist, who had also founded and edited one of the leading botanical journals, *The New Phytologist*. In 1931 he passed the editorship on to Clapham, H. Godwin and W. O. James, who jointly edited the journal for the next 30 years. Roy Clapham's published work carried out while at Oxford indicates the breadth of his interests and includes papers on quantitative ecology, cytotaxonomy and post-glacial vegetation history.

It was also at Oxford that his stress on the importance of synthesis of information began to develop and he played a leading role in the launch of the *Biological Flora of the British Isles* in 1940 and he wrote, with P. W. Richards, several accounts of *Juncus* species. An early problem was the lack of an up-to-date list of British vascular plants. Again Roy Clapham demonstrated his scholarship and ability to achieve a consensus with the publication of a *Check-list of British Vascular Plants* in the *Journal of Ecology* in 1946.

By this time Roy Clapham had moved to the University of Sheffield, where he was Professor of Botany from 1944 until his retirement in 1969. The university benefited from his leadership in many ways. He built up a major Department of Botany and in 1961 founded the Research Unit of Grassland Ecology, supported by the Nature Conservancy. This very successful group still continues in Sheffield as the Unit for Comparative Plant Ecology, supported by the Natural Environment Research Council. He also served as Dean, Pro Vice-Chancellor and, finally, acting Vice-

FIGURE 1. Arthur Roy Clapham, 1904–1990.

Chancellor for a period in 1965. During all this teaching was never neglected and he continued to lead first-year field excursions into Derbyshire, including Kinder Scout, until the year of his retirement.

The post-war years were a period of increasing productivity, culminating in 1952 with the publication, together with the late T. G. Tutin and E. F. Warburg of the *Flora of the British Isles*, our first completely new Flora this century and the work by which all three, affectionately reduced to the acronym 'CTW', are best known to generations of botanists. The *Flora* and its abbreviated companion, the *Excursion Flora*, are both now in their third editions; Roy was involved in the preparation of them all, spanning a period of 35 years of publication.

In 1950 Roy Clapham, speaking at a conference organised by the B.S.B.I. (which he joined in 1945) on "The Study of the Distribution of British Plants", persuasively laid out the ground rules for the production of distribution maps of British vascular plants based on the 10-kilometre squares of the National Grid, even forseeing the production of transparent overlays; a conference proposal endorsing his suggestions was carried "with acclamation". So was set in train perhaps the most successful project ever carried out by the B.S.B.I. and certainly the one which involved most members. Roy Clapham was heavily involved in the project's organisation, which culminated in the publication of the *Atlas of the British flora*, edited by F. H. Perring and S. M. Walters, in 1962. Subsequently the distributions of many other groups of British plants and animals have been similarly mapped.

The 1950s were a time of great importance for the development of nature conservation in Britain. Roy Clapham was deeply committed, being a member of the then Nature Conservancy from 1956 to 1972 and chairing several influential committees during that period. When the Nature Conservancy

came under the direction of the Natural Environment Research Council he was also appointed a council member. From 1964 to 1975 he was also Chairman of the British National Programme of the International Biological Programme. This international project aimed to study the biological basis of productivity and human welfare, by carrying out comparable research in the main ecological areas of the world. Roy Clapham was a natural choice for British Chairman both because of the breadth of his scientific knowledge and his skills in reaching wise decisions from committee discussion.

His diplomatic skills were also recognised by the Royal Society; in 1964 he and Professor Blackett, the physicist, visited China as the Society's representatives and guests of the Academia Sinica in one of the few scientific contacts to be made during the ravages of the Cultural Revolution.

Even during these years of national responsibility Roy Clapham did not neglect his home area, helping to found the Derbyshire Wildlife Trust and acting as its first chairman. He also edited the *Flora of Derbyshire*, published in 1969, and personally wrote ecological notes for every species. It was entirely characteristic that when he came to the draft of *Hieracium* and found it wanting, he took it upon himself to collect material from a number of Derbyshire localities, identify it himself, and *then* send it to P. D. Sell at Cambridge for comment. His breadth of ecological knowledge was also put to good use in his authorship of the *Oxford book of trees*, published in 1975.

Roy Clapham's achievements were recognised by the award of a Fellowship of the Royal Society in 1959, the Presidency of the Linnean Society of London from 1967 to 1970, followed by the award of its Gold Medal in 1972, a C.B.E. in 1969, and an LI.D. from Aberdeen University in 1970. He was also a Trustee of the then British Museum (Natural History) from 1965 to 1975.

Throughout his career Roy Clapham remained modest and unassuming, achieving his influence by quiet persuasion and logic. He was a complete scholar, widely interested in science and natural history, but also a first rate linguist with a love of etymology. It was significant that the University of Sheffield awarded him an Honorary Litt.D. in 1970. He relaxed at home, where he and his wife Brenda entertained their many friends, colleagues and family with good food, wine and conversation.

T. T. Elkington

BARBARA MARY STEYNING EVERARD
(1910—1990)

Barbara Everard (née Beard), the botanical artist, died on 17 June 1990. She was born at Telscombe, Sussex, on 27 July 1910 in the Manor House now owned by the National Trust. Her father was the first cousin of the well-known gardener and author E. A. Bowles (1865–1954) and this may well have inspired her life-long interest in plants and gardening. When I first met her some 17 years ago, she gave me a guided tour of her garden, pointing out enthusiastically the many choice 'E. A. Bowles' plants she had collected from all over the country.

She joined the B.S.B.I. in 1956 and exhibited her paintings and drawings of plants regularly at the Society's Annual Exhibition meeting each November. Many members will have purchased her poster of 'Endangered and vanishing plants' which she promoted at these events. She was introduced to the Society by Ted Lousley at the time of her being commissioned by the Medici Society to produce 900 illustrations of British wild flowers for a proposed *Flora of the British Isles*. She had completed this task by 1963, thanks to the many amateur and professional botanists who had sent her flowering plants by post from all over the country. Her son Anthony remembers as many as 15 parcels a day arriving at their Farnham home, the most memorable being a many times folded specimen of Giant Hogweed. Sadly, the Medici Society never published the book. Barbara will probably be best remembered by B.S.B.I. members for her illustrations in Oleg Polunin's *Trees and bushes of Europe* (Oxford University Press, 1976). Although reproduced at a much reduced scale from the originals, these drawings and paintings exemplify her work. She produced bold and botanically accurate illustrations that reproduced well and this, together with her ability to work quickly, made her popular with both authors and publishers. Barbara also provided line drawings for Oleg's other *Field Guides* to European flowers.

Barbara's main passion in life was for orchids – growing them, painting them and conserving

them. Her introduction to orchids began 50 years ago in Malaya where she joined her late husband Ray, who had taken up a posting there as a rubber planter. From 1938 until World War II intervened in 1942, and again from 1946 until 1950, Barbara lived only a stone's throw from the tropical rain forest and its orchid riches. By 1950 she had gathered together enough paintings of tropical flowers for her first exhibition, which was held at the Singapore Flower Show. From then on her love of orchids grew apace and in parallel with her reputation as a botanical artist. She won eight Gold Medals for her botanical art from the Royal Horticultural Society, including the prestigious Grenfell Gold Medal in 1950 for a display of paintings of Malayan wild flowers. In 1976, combining her interest in tropical flowers, orchids and a growing awareness of conservation matters, she returned to Malaya on a Winston Churchill Travelling Fellowship to illustrate the threatened plants of Malaya. The original paintings from this fellowship have featured in several books, articles and calendars on threatened plants and, were generously donated by Barbara to the Royal Botanic Gardens Kew, in 1987. There they join Barbara's original paintings from Brian Morley's monumental *Wild Flowers of the World* (Michael Joseph, 1970) which will be a lasting testimonial to her skill and dedication.

For many years, Barbara was a leading light in orchid growing circles in the British Isles, originally an active member of the Thames Valley Orchid Society and latterly in the Devon Orchid Society and the Orchid Society of Great Britain. She was a skilled grower and won many prizes for her orchids, the last an Award of Merit from the Royal Horticultural Society for a fine specimen of the Burmese Slipper-orchid, *Paphiopedilum charlesworthii*.

Over the years, she became more and more concerned by the disappearance of the tropical forests and their orchids. Her response to their plight was characteristically positive. Barbara decided that, while she could do little to protect the orchids and their habitats directly, it was possible to protect those same species that were already in cultivation. She had often seen wonderful collections of orchids, lovingly assembled and cared for over decades by their owners, decline or die in a matter of days or weeks when their owner became ill or died. Plants of inestimable value have perished for the want of the owner leaving instructions for their care in the event of an unforseen accident or illness. Barbara, after consultation with friends representing the Orchid Society of Great Britain, other orchid societies, the Royal Horticultural Society and the Royal Botanic Gardens, Kew, found the answer!

In 1986 the Barbara Everard Trust for Orchid Conservation was established as a registered charity provided with its initial capital by the generosity of Barbara herself. The Trustees, representatives of the Orchid Society of Great Britain, Kew and the Royal Horticultural Society decided that the Trust should be named after Barbara Everard in gratitude for her generosity and the leading role she had taken in its establishment. The primary aim of the Trust is to conserve orchids in cultivation. One of its main roles is seen to be the establishment of a mechanism by which collections can be rescued in the event of the owner's death or serious illness. Several thousand plants have already been rescued and will continue to delight future generations.

P. J. Cribb

RICHARD PEARSE LIBBEY
(1911—87)

During the last five years, Norfolk has lost four of its eminent botanists. Richard Libbey, the authors of the most recent Flora of the county, Charles Petch (1909–87) and Eric Swann (1904–89), and the widely loved all-round naturalist, Ted Ellis (1909–86), the subject of a recent biography (Stone 1988), represented a remarkable generation of field botanists. The late 1980s has been indeed, to use that well-worn but appropriate phrase, the end of an era (vide Daniels 1990).

Richard Libbey was born on 9 March 1911, the son of the Rev. H. C. Libbey of Huddersfield, Yorkshire. He was educated at St John's School, Leatherhead in Surrey, and the Technical College, Huddersfield. He went up to the University of Reading in 1930, where he read Agricultural Botany and graduated, after an absence through illness, with First Class Honours in 1936. In 1936–7 he carried out research on Thames Valley grasslands under the supervision of Professor W. B. Brierley, although he did not pursue this work through to a higher degree. Instead, he followed up

his interest in grasses by joining the staff of the Board of Greenkeeping Research (later the Sports Turf Institute) at Bingley near Leeds in his native Yorkshire.

During World War II, after volunteering for active service in 1939, he was appointed to the War Agricultural Committee for Norfolk. By then he had married Alice Clark, another graduate of Reading University. They had three children. After the war, the family returned to Yorkshire, but subsequently moved back to Norfolk, to King's Lynn, where Richard worked for a company that manufactured fertilizers.

He was an enthusiastic member of the B.S.B.I., which he joined in 1943, and he was an important contributor to the *Atlas* mapping scheme, as well as attending many meetings all over the country especially after his retirement in 1971. Much of his Norfolk field-work was with Eric Swann, and records that they collected together were included in Swann's *Supplement to the Flora of Norfolk* (1975). I remember Richard Libbey as a friendly and helpful person, willing to give encouragement to a young, inexperienced botanist, not least in indicating most tactfully a gross error in my first publication. He was a member of the Council of the British Bryological Society, and devoted much of the last four years of his life to bryology. His bryophyte herbarium has been lodged at the Castle Museum, Norwich, although his herbarium of Higher Plants, comprising some 12,000 sheets, is now at the University of Leicester herbarium (**LTR**). As well as having a wide knowledge of grasses, he was the B.S.B.I. referee for the genus *Oxalis*.

REFERENCES

Daniels, E. T. (1990). The end of an era. *Trans. Norfolk Norwich Nat. Soc.* **28**: 336–340.
Stone, E. (1988). *Ted Ellis, the people's naturalist*. Norwich.

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